JPRS-CST-85-018

12 June 1985

China Report

SCIENCE AND TECHNOLOGY

FBIS FOREIGN BROADCAST INFORMATION SERVICE

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL
INFORMATION SERVICE
SPRINGFIELD, VA 22161

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS-CST-85-018

12 June 1985

CHINA REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

PEOPLE'S REPUBLIC OF CHINA

NATIONAL DEVELOPMENTS

ABSTRACTS

NATIONAL DEVELOPMENTS

NIE RONGZHEN INSCRIPTION FOR TECHNOLOGY FAIR

OW131331 Beijing Domestic Service in Mandarin 1200 GMT 10 May 85

[Text] A trade fair on scientific and technological achievements sponsored by the Ministry of Astronautics, opened at the Military Museum in Beijing today. Comrade Nie Rongzhen personally wrote an inscription for the fair. The Inscription reads: Congratulations on the great achievements over the past three decades; wishes for new breakthroughs in astronautics research.

China's astronautics industry is a newly developed industry. Through efforts over the past three decades, the Ministry of Astronautics has made contributions to developing guided missiles and satellites. The ministry has made voluminous scientific and technological achievements which have passed technical tests in recent years. Among them, 3 research projects have won state natural science awards, 28 research projects have won state inventions awards; and over 4,450 research projects have won awards from the National Defense, Science, Technology, and Industry Commission for Important Scientific and Technological Achievements.

Since the implementation of the policy of integrating military and civilian production, most of the factories and research institutes under the Ministry of Astronautics have arranged for the production of civilian products. The output value of civilian products has already exceeded the output value of military products in 1984.

The current trade fair is the largest ever sponsored by the Ministry of Astronautics. On display at the fair are guided missiles technology, satellite technology, specialized processing technology, precision processing technology, automation technology, materials technology, remote-sensing and remote-surveying technology, precision measurement technology, power installations, and important scientific and technological achievements in computer technology, as well as light industrial products, food processing equipment, petroleum and mining machinery, medical apparatuses, broadcasting and communications equipment, navigational equipment, measuring instruments and meters, electronics components, household appliances, and various types of vehicles, a total of over 2,500 items. Among them, 1,800 items are civilian products.

CSO: 4008/341

NATIONAL DEVELOPMENTS

COMMENTARY PRAISES ROLE OF SCIENCE, TECHNOLOGY MARKETS

HK160527 Shijiazhuang HEBEI RIBAO in Chinese 4 May 85 p 1

["Short" commentary: "Vigorously and Satisfactorily Run Science and Technology Markets"]

[Text] The results attained at the second Hebei provincial science and technology fair for 1985 show once again that vigorously and satisfactorily running science and technology markets plays an important role in stimulating the development of science, technology, and the economy.

First, by running science and technology markets vigorously and satisfactorily we can solve the difficulties in transferring scientific and technological achievements. Due to the separation of departments and regions at different levels, numerous achievements in science and technology have been isolated. By running science and technology markets, we can break down these barriers and unclog the channel between achievements in science and technology and the needs of various quarters.

Second, by running science and technology market vigorously and satisfactorily we can solve the difficulties of small and medium-size enterprises, township enterprises, rural specialized households, and economic combines in seeking science and technology. On the science and technology markets, suitable and complete sets of technologies and information on competent personnel are displayed and supplied in large quantities so that people can make choices according to their own needs, thus saving time, trouble, and energy.

Third, by running science and technology markets vigorously and satisfactorily we can solve the difficulties of scientific research units in seeking tasks. On the science and technology markets, production units can commission scientific research units to conduct research for them or to give them technological guidance, thus strengthening the horizontal links and cooperation between them, promoting the use of science and technology in solving production problems, and tapping the potential of scientific research units.

Fourth, by running science and technology markets vigorously and satisfactorily we can stimulate scientific research units to gear themselves to the needs of production and to serve economic construction. At the science and technology

fair, some items attracted more business than the suppliers could handle and many transactions were concluded. Some other items, however, attracted such little attention that few transactions were concluded. Undoubtedly this will stimulate scientific research units to gear themselves to the needs of production units more satisfactorily and to attain more scientific and technological achievements which will be readily marketable.

Fifth, by running science and technology markets vigorously and satisfactorily we can promote the rational flow of competent persons. Technology markets provide information as well as discussion opportunities and sites for the employment of scientists and technologists and other forms of personnel flow so that a large number of scientists and technologists can find units where they can display their abilities or talents.

CSO: 4008/341

NATIONAL DEVELOPMENTS

TECHNOLOGICAL MARKETS VITAL TO ECONOMY

Beijing GUANGMING RIBAO in Chinese 27 Dec 84 p 1

[Article by Zheng Haining [6774 3189 1380]: "Opening Technological Markets is Vital to Economic Development; SSTC Spokesperson Points This out in a Statement for Publication"]

[Text] On 26 December, a spokesperson for the State Scientific and Technological Commission (SSTC) in making a statement for publication to reporters, pointed out that the question of technological marketability and markets will be of vital importance in economic development, and that the opening up of technological markets is a fundamental measure in implementing the policy of "economic construction must rely on science and technology, while science and technology must be geared to economic construction."

The SSTC spokesperson said that in China's socialist commodity economy, technology is increasingly being recognized as a particular kind of commodity, and it is also becoming the most valued of commodities. Opening technological markets will be of great importance to China's technological progress and the vigorous development of our economy.

According to the spokesperson, jurisdiction over technological results is determined by consideration of who supplied the material and labor which was used to accomplish the results. At present, jurisdiction over the benefits deriving from technology transfer are determined more or less as follows. First, whichever nation provides the financial support for research results is the proprietary nation; if the results lead to a patent, the results are then handled according to the provisions of the patent laws, with the research unit eligible for transfer payment, so long as the relevant national regulations are observed. This payment ordinarily will go to the unit in charge. Second, research results which were done for an enterprise, and with research funds provided by that enterprise, will in general be turned over to the investing party; with the express agreement of the investing party, the research unit can transfer results for payment, with the two parties negotiating division of the income. After a set time limit, all compensation should go to the research unit. Third, if S&T personnel of either the research unit or the enterprise assume responsibility for research results in that unit's program, then that is the unit having proprietary rights. In the three research results cases described above, the unit transferring the technology can retain a certain

portion as payment for their expenses and then allocate this among the persons in charge of the project, as an award to those directly involved in the research: developmental S&T people or those who have made important contributions. In addition, research personnel or project groups, with the goal of completing their unit's planned mission and in keeping with the needs of production units, can on their own assume responsibility for a technological mission, consultation or technological development. In these instances, their units should give positive support. Research results can be based on the units' subsidies, with jurisdiction and benefits jointly negotiated. After the S&T personnel have finished their work, they can then become involved in such service as consulting, developing the technology society needs, etc., supported by their units, and with results and income returning to them. If it is necessary to use a unit's instruments and equipment, etc., then that unit should provide these, levying fees according to the circumstances. Negotiating the price of technological results is much more complicated than with ordinary commodities. One cannot figure the cost by simply taking the cost of producing the commodity and then adding on a certain profit; moreover, evaluation should be based on the results' applicability to production and the resultant economic benefits. The price of technological results is adjusted with the mechanism of the marketplace. At the present time, it is not easy to limit the price of the results of technology, and moreover the "demand" for these results must be taken into account. In order to further the development of technological markets, in a transaction involving technological results, both sides can negotiate and conclude a deal on the principle of mutual benefit.

The SSTC spokesperson stressed that implementing the commercialization of technology can attract numerous S&T personnel in the near future to projects that are of genuine economic benefit, and this is precisely what socialist construction needs. As for those projects which are national priorities and are medium to long term, these will be carried out under the guidance of national instructions and directives. The state will perfect management methods, utilizing to the fullest economic measures which are designed to attract S&T personnel into research, thereby ensuring completion of the nation's priority projects. The spokesperson went on to point out that S&T personnel should, on the premise of ensuring completion of their responsibility, engage in scholarly activity in their spare time. If S&T personnel use their spare time to serve socialist construction it would be good for both China and the Chinese people. They deserve to be paid for their hard work, of course; this cannot be criticized. As for those S&T personnel whose spare time income is relatively large, they should pay income tax in accordance with national regulations.

Finally, the spokesperson pointed out that opening up technological markets is a central mission for science committees at every level and for concerned leading departments. This is a vital matter which definitely deserves that a great deal of time be devoted to it. The State Council has charged the SSTC and the State Economic Commission to take a leadership role in this matter, and has charged such other units as the National Defense Science, Technology and Industry Commission to participate in organizing, promoting and coordinating the work of developing technological markets.

NATIONAL DEVELOPMENTS

LABOR DIVISION, COOPERATION URGED FOR S&T ORGANIZATIONS

Beijing RENMIN RIBAO in Chinese 28 Jan 85 p 3

[Article by Zhou Peiyuan [0719 1014 3293]: "On the Division of Labor and Cooperation Among the Three Science Organizations"]

[Text] In the 35 years since the founding of the PRC, along with the steady development of industrial and agricultural production, our nation has formed its own S&T system, namely: the State Scientific and Technological Commission, the scientific academies and institutes represented by the Chinese Academy of Sciences, and the China Association for Science and Technology--the mass organization of the S&T community. These 'three scientifics' as a system, when compared with other nations, are fairly complete, bringing into full play or just in the process of bringing into full play their functions. However, our 'three scientifics' were all founded just after liberation or during the 1950s. The national situation today is considerably changed, with societal production, research tasks, the organizations and personnel all greatly developed. This has especially been the case since the Third Plenary Session of the Twelfth Central Committee, when China's development entered its new period of soaring. The CPC Central Committee's "Resolution on Reform of the Economic System" points out that, "Along with reform of the economic system, reform of the S&T and educational systems has increasingly become a strategic mission urgently requiring solution." How to still more fully utilize the "three scientifics" and positively mobilize the broad ranks of S&T personnel, are pressing questions of S&T system reform which await solution.

I believe that a maximum effort must go into reforming the "Three Scientifics"

The "three scientifics" must have a clear-cut division of labor.

The principal tasks of the Scientific Commission are: to implement the programs and policies of the party Central Committee which are concerned with science and technology; to draw up plans for development of China's science and technology; to monitor the implementation of these plans, including establishing important research academies and institutes, and judging the importance of research projects; organizing the application and popularization of S&T results in production; concluding S&T agreements with foreign nations, etc. In short, the Scientific Commission is the highest authority in the administration of science and technology in China. Its position in the State Council

should be equal to that of the State Planning Commission and the State Economic Commission. It should concentrate its energies on mastering national policy on science and technology. There are other units capable of handling certain non-essential tasks assigned by the State Council, so authority for these should be delegated by the SSTC.

China's scientific research contingent consists of five divisions, and of these the strongest single division consists of the more than 100 research institutes and jointly-run research units under the CAS. Among the nation's scientific research units the CAS occupies a prominent position. As Premier Zhou Enlai pointed out in his 1956 work titled, "Guanyu Zhishifenzi Wenti di Baogao" [Report on the Question of Intellectuals], "Concentrate the best scientific strength and the best university graduates in scientific research. Strive to the utmost to strengthen the CAS, so that it will take the lead nationally in raising the level of science, and be the locomotive which develops the newly emerging forces." In other words, we should make the CAS China's top-ranking scientific research organization. The research units of the CAS are China's national research team. They should be engaged in research projects which are significant and comprehensive, which other scientific research units are unequipped to carry out. For this reason, the research institutes under the CAS all should become national research institutes serving national requirements. Reform of the CAS will certainly stimulate reform of research academies and institutes which are under the leadership of other national departments. In recent years, in addition to such mass work as organizing domestic and foreign scholarly exchanges, developing S&T training and the S&T activities of young people, the China Association for Science and Technology [CAST] has also developed into the principal supplier of S&T consultation services for industrial and agricultural producers, promoting production and raising their economic benefits. The various learned societies which belong to the CAST and local S&T associations at all levels have a total membership of several million; among these are included the nation's scholarly experts from all fields of knowledge and vast numbers of skilled craftsmen and popular science enthusiasts among our youth and in our rural areas who are also making research accomplishments. Because of this, these S&T associations at various levels are potential S&T advisors and brain trusts for various levels of government, from central to local.

We Must Strengthen Large-Scale Socialist Cooperation Among the "Three Scientifics," And Between Them and Other Departments

In cooperation between the "three scientifics," we can point to controlled nuclear fusion reaction research as an example. In the long run, controlled nuclear fusion will be an important future energy source. In a situation where the supply of natural fossil fuels (e.g., coal and petroleum) and nuclear fission materials (e.g., uranium) are diminishing daily, the energy obtained from nuclear fusion reactions in light atomic particles (e.g., Tritium + Tritium), can supply society with an almost limitless supply of clean, safe and cheap power. This vitally important research effort is being carried out energetically in the United States, Western Europe, the Soviet Union and Japan. Because it involves many aspects, such as research, education and production, and is very expensive, it is not something that will be in place in the near

future. Therefore, it becomes even more imperative for the SSTC to take the lead in formulating a long-range program which is national in its scope and progressive. The fundamental research projects in the program should be undertaken by the CAS, with the remainder of the projects divided among other concerned departments for implementation. The SSTC can cut across the relationship between the CAST's organizations, and from such consultative work as setting up research strongholds and deploying research personnel, will in doing so lay the scientific foundations. Opening up new energy sources is a frontline mission of socialist construction. We must prepare soon, and try hard to catch up, for we absolutely cannot wait until the 21st Century when other nations have obtained results, and then "import" these.

Domestic and foreign experiences have demonstrated that institutions of higher education cannot improve the quality of their teaching until they have vigorously developed their scientific research, turning out both results and qualified personnel. In general, since the establishment of the PRC and largely due to historical reasons, insufficient attention has been given to scientific research in our academic institutions. Starting in the 1950s China set up numerous research academies and institutes; this was right and necessary. But at the present time, the bulk of our research strength is concentrated in the universities, and this personnel is basically also the membership of China's science societies. If they are given certain material conditions, they are totally capable of carrying out research assignments given to them by the nation's concerned departments. Therefore, in this particular reform of the S&T system, some departments' research projects can doubtless be assigned to academic institutions for implementation. Unless it is done out of absolute necessity, it is essential that we not rush into setting up new research academies and institutes. The widespread development of scientific research in our institutions of higher education is a frontline mission in the development of our S&T professions, and must have the fullest support from the "three scientifics" and concerned departments.

Besides this, in scientific research it is essential to eliminate such inter-unit phenomena as each acting for itself, blocking each other off, and failure to communicate, all of which run counter to cooperation. The utmost effort must go into encouraging close cooperation between units and personnel, each supplying what the other needs, with mutual assistance, avoidance of duplication and waste, making the fullest use of the spirit of socialist cooperation, and moving forward together.

Since the establishment of the PRC, we have not only established a fairly complete research system, we moreover have a clear S&T developmental policy. In the words of Premier Zhao Ziyang, this policy is that "Science and technology must serve economic construction, and economic construction must rely upon science and technology; basic research cannot weaken." To seriously implement the party's S&T policy, under the circumstances of the simplified reform of political rights, the "three scientifics" have the authority within the system to carry out positive transfer and mobilization of S&T personnel and cadres over a wide area.

In reform of the S&T system it is imperative that we encourage a system of appointive, competitive, contractual responsibility, setting up research funds, rewards, etc. These are important measures which will mobilize the enthusiasm of S&T workers, and quickly produce results and trained personnel. All this must have the firm leadership of party committees at all levels to be assured.

Historically, these are the best of times since the founding of the PRC. Our S&T workers and people throughout the nation are as one in looking forward to a glorious future, facing it with complete confidence, and eager to offer advice and make suggestions concerning the reform of the S&T system. This will advance the contributions which development of science and technology will make towards our wisdom and strength.

12625
CSO: 4008/214

NATIONAL DEVELOPMENTS

GANSU GOVERNOR STRESSES TECHNOLOGICAL PROGRESS

HK190225 Lanzhou Gansu Provincial Service in Mandarin 2300 GMT 18 May 85

[Excerpts] The general demands on technological progress and transformation in Gansu this year are: Ensure the key points, improve the standards, seek economic results, and raise capital in a variety of ways. This demand was put forward by Governor Chen Guangyi in his report at the third session of the sixth provincial people's congress.

He said: The state has decided to base economic development in the next few years on the existing enterprises, and resolutely focus investment on promoting technological progress and on technological transformation, modification, and expansion of existing enterprises. This is a task that brooks no delay. This is the way to maintain the reserve force for the province's economic development.

Ensuring the key points means giving priority to ensuring technological transformation of some key enterprises and for some key products. Raising the standards means making maximum use of advanced Chinese and foreign technology. World technology is developing very fast now, and we must become adept with the most advanced technology. We must import software as well as hardware, to arm ourselves technologically at a faster speed.

Seeking economic results means attaching great importance to the economic results of technological progress and transformation. At present the province's economic results in this respect are not good enough. This year we must attach importance to and embrace the viewpoints of turnround of capital, of three dimensions, and of getting projects into production, and take a big step forward in economic results.

We must raise capital in a variety of ways. We must widen our vision, raise more capital from society, and tap the potentials of capital, so as to speed up the pace of technological advance and transformation.

CSO: 4008/341

NATIONAL DEVELOPMENTS

HEBEI PROVINCE CONCLUDES SCIENCE, TECHNOLOGY FAIR

HK160459 Shijiazhuang HEBEI RIBAO in Chinese 4 May 85 p 1

[Report by an unnamed correspondent: "The Second Provincial Science and Technology Fair Successfully Ends"]

[Text] The second provincial science and technology fair for 1985 successfully ended on 29 April.

A total of 142 units participated in the fair. They supplied more than 5,000 items of transferred technology and more than 3,000 pieces of technological and economic information, invited bids for 358 items, and displayed for sale as many as 1,000 new products as a result of scientific research.

The fair received more than 22,000 people from provinces 22 and municipalities [as printed], including this province, Beijing, Tianjin, Shanxi, Shandong, Fujian and Anhui. At the fair, 1,924 technological items were transferred; 404 personnel exchanged; 123 integrated bodies set up; 282 technological cooperation relationships established in various forms; 694 bids received for 304 items, accounting for 85 percent of the 358 items offered; 37,000 pieces of technological information or data transmitted contracts signed for the training of 1,803 persons, and new products of scientific research sold worth more than 1 million yuan. The total volume of transactions was 34.16 million yuan.

In our province, 47 scientific research units and 23 institutes of higher learning participated in the fair and transferred 537 technological items to production units. They also committed themselves to undertake 195 research tasks, agreed to train 1,303 technical personnel, and set up 63 scientific research and production combines. Many research institutes received enough tasks for the whole year. If some of them succeed in fulfilling the contracts according to schedule, they will be able to achieve economic self-sufficiency.

At the fair, those items which need less investment but yield quick returns and better results were very popular. For example, the plastics research institute of Handan City supplied technology for manufacturing carved and decorated artistic boards. Needing an investment of only 20,000 yuan and 1 month for the training of personnel for production, this venture only needs 20 people

to carry out a batch process and can yield an annual profit of 300,000-500,000 yuan. The institute originally planned to limit the production of these boards to three factories in this province, but as many as 26 units requested the technology at the fair. Most of the transactions concluded at the fair included a full set of technological services such as full responsibility for technological guidance, installation of equipment, training of personnel, manufacture of quality products, and attainment of better economic results. Some transactions even included full responsibility for the sales of products so that the transfer of technological achievements could yield quicker economic results.

At the fair, not only were bids for tough production and technological problems invited by production enterprises and rural communes and brigades, but bids for scientific research items listed in the state plans were also invited on an experimental basis, thus bringing about a major reform in the management method for scientific research plans and tasks. Public bids for the 125 scientific research tasks listed in the provincial plan for this year had the greatest appeal at the fair. In 7 days, 314 bids for 119 tasks were entered, and bids for some items were even submitted by more than 10 units. Not only did scientific research and design units, institutes of higher learning, and production enterprises in our province energetically submit bids, but a large number of technical personnel, collective enterprises, and households specialized in scientific and technological matters from other provinces and municipalities also vied with one another to bid. Because bids on one item could be submitted by many units, there was competition among the bidders and thus money could be saved. Some tasks which were hard to handle in the past are now being hotly contested for by many units. This has created extremely good conditions for selecting the superior contracting units and has greatly shortened the time needed for handling the tasks.

CSO: 4008/341

NATIONAL DEVELOPMENTS

GUANGXI SCIENTIFIC, TECHNOLOGICAL WORK CONFERENCE OPENS

HK150750 Nanning Guangxi Regional Service in Mandarin 1130 GMT 14 May 85

[Excerpts] A regional conference on scientific and technological work ceremoniously opened in Nanning this morning. The opening ceremony was presided over by Chen Huiguang, deputy secretary of the regional CPC committee.

At the opening ceremony, Wei Chunshu, deputy secretary of the regional CPC committee and chairman of the regional people's government, made a report on reform of the system of science and technology. He said: The tasks of the regional conference on scientific and technological work are to study the spirit of decision of the CPC Central Committee on reform of the system of science and technology and to discuss and revise the decision of the regional CPC committee and the regional people's government on reform of the system of science and technology in conjunction with the actual situation of our region.

Comrade Wei Chunshu dealt with five points concerning views on how to carry out reform of the system of science and technology in conjunction with the actual situation of Guangxi:

1. Reform of the system of science and technology is imperative.

2. The main contents of reform of the system of science and technology: After Comrade Wei Chunshu talked about the specific contents of reform in three aspects, operation and [words indistinct], organizations and organs, and the system of personnel, which should be grasped in current reform of the system of science and technology, he demanded: Leaders of the party and government at all levels must regard reform of the system of science and technology as important work and must strive to grasp it well.

3. Regarding the problem of opening to the outside world, Comrade Wei Chunshu pointed out: Our region's technological forces are weak and it will not work to close our country to international intercourse. We must import science and technology from each other and rely on each other to speed up economic development. In opening, we must open not only to the outside world but also to other places in our country and in our region.

4. Regarding the problem of qualified personnel, Comrade Wei Chunshu hoped: Leaders of the party and government at all levels will rely on scientific and technological personnel and will trust their socialist awareness, so that they will wholeheartedly plunge themselves into the four modernizations. It is necessary to retain the qualified personnel whom we now have and to give play to their role. It is also essential to absorb qualified personnel from other places.

5. As to the problems of strengthening leadership and carefully giving guidance, Comrade Wei Chunshu emphasized: Leaders of the party and government at all levels must strengthen leadership over reform of the system of science and technology in ideology and action, must rely on scientific and technological personnel and creation by grassroots units, must coordinate the forces of all quarters, and must promptly solve the new problems in the course of reform. Through reform of the system of science and technology, we must invigorate Guangxi's economy.

CSO: 4008/341

NATIONAL DEVELOPMENTS

JILIN TO REFORM S&T SYSTEM

Changchun JILIN RIBAO in Chinese 4 Jan 85 p 1

[Article: "Jilin Science Commission's Party Rectification Work Produces a New Atmosphere; Corrects Professional Work's Leading Thought; Corrects Unhealthy Tendencies Toward Secret Trickery"]

[Text] Leading personnel in the Jilin Science Commission are taking the lead in the study of documents which deal with party rectification. They have exposed problems, cleared out "leftist" influences, and by taking personal responsibility for handling this vital program, they have obtained better results. The results are that throughout the entire organization there has emerged a unified, wholehearted committment to carry out the four modernizations, to vigorously reform and strive for achieving a new atmosphere. In the process of party rectification, the Science Commission has from beginning to end persevered in seizing this basic problem of "leftist" tendencies, by rectifying the thought which guides the Science Commission's mission. They have made it clear that the Jilin Science Commission's basic mission is to grasp macroscopic management and comprehensive cooperation, sparing no effort to bring the entire province's S&T work to its best. Therefore, they have proposed implementation of "three transformations and three reforms."

The three transformations are: (1) Transform the original, single-responsibility research projects into projects which not only stress the essentials but also comprehensive management and cooperation. Last year, the provincial science commission, led by leading comrades, went in July and November into every city and locality, stressing investigative research and the carrying out of on-site operations, to solve grass roots problems which were in urgent need of resolution. In order to formulate a policy for Jilin to use in meeting the challenge of the new technological revolution, starting in March of last year, the science commission organized over 90 specialists arranged by manufacturing industry and technological zone, to draw up the background materials for 38 long-range S&T development programs. This is in order to provide a reliable basis for the provincial commission and government to make policy decisions. The problem of research on grain is a matter of great importance in Jilin for leaders and the masses alike. Not long ago, over 30 specialists from production departments and research units in the provincial science commission's organization carried out a number of investigations and proofs which led to their proposing 11 research topics, of which 7 have been approved by the

government for implementation. (2) Transform the current emphasis on laboratory research into a grasp of technological preliminary research and reserves, and stress on organizing research personnel for problem-solving in actual production. Prior to last July, the science and economic commissions, working jointly, organized 8,845 S&T personnel from throughout the province to go into enterprises and rural areas, seeking solutions to key technological problems in production. At the same time, they also organized S&T specialists to carry out an administrative diagnosis of the technology and management in about 100 important enterprises in Jilin. They will help these important enterprises draft a program for technological transformation, and propose ways in which they may increase surpluses and decrease deficits. (3) Transform the S&T program from a closed to an open style of management, then from one of layer upon layer of research units reporting to higher bodies, and multiple layers of science commissions reviewing each project, to one which openly invites public bidding. On a foundation of thoroughly investigating research and listening carefully to the views of specialists, they have drafted an initial list of proposals for 26 research projects that could be of importance in developing the economy of the entire province; these will then be opened up for bidding to the public both within and outside the province.

The three reforms are: (1) Reform of the research system. As part of the party consolidation the science commission drew up a plan for reform of the science research system, with a decision to abolish operating expenses and institute the paid contract system on a trial basis in eight technologically developed research institutes. The Jilin Science Commission further decided that in research institutes which are concerned with the exploitation of research, the paid contract system will be implemented, and operating expenses abolished until 1989. Those research institutes which combine the exploitation of research with its application will adopt a system whereby their funding is paid partly in kind and partly in cash. Those research institutes which combine applied and basic research (including research institutes which are chiefly concerned with serving society) will implement the funding system. At the same time, they are setting up a strict and impartial system of rewards and penalties for research management personnel. (2) The second is reform of the management of S&T programs. They decided to adopt the power of special transfers and the leading method of comprehensive concentration, so that in research programs, management will be carried out according to grade. Last year, in the entire province there were a total of 306 research projects arranged by plan, of which only 62 were managed by the science commission (including 21 national priority projects), with the remainder managed by various localities and departments, sharing the responsibility. Beginning in 1985, the expenditures for three items under the science commission's control, 33 percent (originally 10 percent) will be taken out and given to cities and localities to control, according to each place's research projects. The science commission will have chief responsibility for research projects and national priority projects which cut across industrial and regional lines, which are sythesis or newly emerging technologies. (3) The third reform is a change from merely employing administrative methods to manage science and technology, and maximize the use of S&T personnel. Establish provincial science commission advisory committees and specialist organizations. Replenish and strengthen every professional society (scientific societies). Determination

of research projects, formulation of science programs, appraisal of and reward for research results, all these should be given in advance to concerned specialists for proof, investigation and assessment.

In their party consolidation, the provincial science commission will not cover up such organizational problems as some cadres using S&T operating expenses for personal gain and getting into trouble. They have taken the initiative by inviting such departments as the Jilin Discipline Inspection Committee, Finance Department and Auditing Bureau to jointly form a work organization which will be stationed in the science commission organization and throughout the entire province, responsible for putting in order and solving any problems which remain in the use of S&T operating expenses.

At the same time as this, with the strong support and cooperation of several departments, they are solving such unhealthy tendencies as corruption, making a breakthrough for correct practices, persisting in this relentlessly, and stressing it to the end. One problem which was resolved was that of staff and workers occupying more than their share of housing. The Jilin Science Commission's leading party group is determined to carry out the Discipline Inspection Committee's "Open letter" and the provincial committee's directive; proceeding from the actual conditions of the science commission, they have stipulated that if one exceeds 10 square meters, then the overage must be returned and an adjustment made. If a month passes without this return, then those who are occupying more than their share will have their rent increased fivefold. If more than two months pass without return, then there will be a one grade demotion in pay, in addition to the fivefold rent increase. Throughout the commission there was a total of 133.97 square meters of housing space which was occupied to excess, but by last Spring Festival there were actually 147.1 square meters which were returned. A second problem solved was that of defaults on public money. By last year's Spring Festival, other than two comrades who for special reasons were repaying over a period of time, all money in arrears had been totally paid back. The third was a check on the unhealthy tendency to exploit the cheapness of labor, by spending little if anything on agricultural by-products and manufactured daily necessities, but rather bartering the cost differential instead. The commission's initiative in this regard handed over to the organization a cost differential of 4,226 yuan, 4 jiao and 8 fen.

12625
CSO: 4008/214

NATIONAL DEVELOPMENTS

SHANGHAI ESTABLISHES TALENT BANK

Beijing RENMIN RIBAO in Chinese 28 Jan 85 p 1

[Article by Xiao Guangen [5153 7070 2704]: "An Attempt to Reform the S&T Personnel Management System; Shanghai Establishes Human Talent Bank in Order to Vigorously Promote the Circulation of Talent"]

[Text] An inaugural meeting was held this afternoon which focused on the already existing Shanghai talent bank. This is an innovative attempt and a new exploration in the reform of our system of S&T personnel management.

The concerns of the "human talent bank" are:

(1) Units which received assignments but temporarily cannot handle these due to limits on their facilities and number of personnel. These units need to import S&T personnel, personnel previously rejected for legitimate reasons, or who have resigned, or who have gone "into storage."

(2) Receiving the trust of employing units, to carry out advertising for jobs, placing ads, assessing technical proficiency, selecting the best for employment, etc., a "coordinated process," coordinated with all levels of S&T personnel.

(3) For S&T personnel "in storage," the bank offers intellectual development, organizing them to carry out external technical services that are regular, directional and suit their specialties.

(4) For personnel "in storage" who are either engaged in advanced studies here or abroad, or are applying for examinations, the talent bank will, according to their dissimilar circumstances, provide short term training or the opportunity for training in a second career.

Since the "human talent bank" was begun on a trial basis on 1 December of last year, 14 units have recommended a batch of S&T personnel for "going into storage," and 64 S&T personnel have made application to do so. The total number of job ads placed for all participating units has been 1,084. In addition, 14 units have requested the "bank" to carry out the "coordinated

process" for them. At present, of the 10 S&T personnel formally "in the pool," 4 have been placed with new work units and 4 are taking part in S&T missions. The "bank" is now conducting three training classes in economic contract law, enterprise management and foreign language training, in order to improve pool personnel's knowledge and capability in modern management.

12625
CSO: 4008/214

NATIONAL DEVELOPMENTS

CAS-HUNAN COOPERATIVE S&T AGREEMENT SIGNED

Beijing GUANGMING RIBAO in Chinese 25 Dec 84 p 1

[Article by Zheng Haining [6774 3189 1380]: "Hunan S&T Delegation in Beijing to Establish 'Kinship' With CAS; Two Sides Conclude Long-Term, Comprehensive Agreement of Cooperation; CAS to Send Coordinators to Hunan, Province Will Give Them Preference"]

[Text] On 24 December, a 25-person S&T delegation, led by Hunan Vice-Governor Cao Wenju [2580 2429 5282], arrived in Beijing to establish "kinship" with the CAS. The two sides, adhering to the principle of mutual benefit, concluded a long-term, comprehensive agreement of cooperation. This will speed up the transfer of results and promote development of Hunan's science and technology and its economy.

The two sides agreed that: when the CAS transfers existing research results, it will consider Hunan's requirements in regard to economic development and arrange for their application in Hunan in so far as possible. When there are important research or production technology problems in Hunan's national economic construction, the CAS will have a program which arranges for subordinate units to carry out research on these, and assist in finding solutions. The CAS has already obtained preliminary results, and will carry out expanded, intermediate and productive experiments in Hunan, while the province will be responsible for providing the necessary facilities and enthusiastic cooperation. According to Hunan's situation and needs, the two sides will jointly take on missions of national priority, conducting research and production, coordinated tackling of key problems, and development of new technologies, materials and products. The two sides will mutually exchange information and technology.

The two sides agreed to the following cooperative, reciprocal model: CAS will transfer research results to Hunan and, based on the size of economic benefits, the benefiting unit will repay the transfer expenses, either in a lump sum or in a series of payments. The CAS, accepting advanced technology as payment into the partnership, will set up a jointly financed technology development corporation, or jointly develop certain new products under common management with division of profits according to shares held. These will be long term agreements. The CAS will provide Hunan with consulting services for the benefiting units and, based on the mission situation and the degree of

difficulty of the technological problems solved, give remuneration locally to higher technology mission units, rewarding those who have obtained important benefits.

Personnel sent by the CAS to Hunan to work on cooperative missions will be given preference by the province in such matters as living allowances, welfare, payment, room and board, etc. It is also stipulated that personnel who are assigned as consultants to enterprises will be paid consulting fees.

12625
CSO: 4008/214

NATIONAL DEVELOPMENTS

CAS TO ADOPT INCENTIVES FOR YOUNG S&T PERSONNEL

Beijing GUANGMING RIBAO in Chinese 8 Jan 85 p 1

[Article by Zheng Haining [6774 3189 1380] and Zou Anshou [6760 1344 1108]: "CAS Will Adopt Measures to Encourage Excellence Among Mid-Career S&T Talent; Yan Dongsheng Informs This Paper That There Will be Award Funds Established in Educational Departments, Scholarly Commissions and Scholarly Journal Editorial Committees to Enrich Mid-Career S&T Mainstays, Subsidizing and Rewarding S&T Personnel Under the Age of 35 Who Have the Ability to be Innovative"]

[Text] Yan Dongsheng [0917 2639 3932], Secretary and Deputy Director of one of the CAS's leading groups, told reporters from this paper during a working conference of the CAS that the organization will adopt positive measures to encourage mid-career S&T talent to excel as quickly as possible.

Yan Dongsheng said that the manpower question is one which has important frontline significance for construction of the four modernizations. The on-going problem before us is: the practice of arranging personnel by seniority is more serious than formerly, so large numbers of mid-career mainstays cannot be brought into fullest use; excellent talent among our young people find it very difficult to stand out, and do not have the opportunity and recognition that comes from putting their abilities to best use. Yan Dongsheng stated that in order to enhance the development of China's science professions, the CAS has decided to adopt positive measures, and bring into full play the use of this mid-career backbone, encouraging them to stand out as quickly as possible. The CAS will continue to bring into leadership positions as quickly as possible excellent mid-career S&T personnel who have done quality research work, or who possess ability in socialist positions and organizational management. These will be from the membership of educational departments, scholarly commissions and editorial committees of scholarly journals, to replenish the mid-career S&T backbone. Regardless of the depth of their credentials, mid-career S&T personnel who fit this profile should be firmly and boldly elevated promptly to high ranking S&T positions. Those S&T personnel who go abroad to participate in scholarly meetings, cooperative research, give lectures, engage in advanced study, etc., will be given permission to leave the country, so long as they can obtain foreign financial support. If there are S&T personnel who request transfer due to difficulties in coming into full use in their own units, the units cannot stand in their way. Those who desire to publish an article in a foreign scholarly journal will also receive encouragement and support.

Yan Dongsheng urged that we be more visionary in our outlook, studying the developmental needs of the next decade and beyond, and taking pains with the maturation of even more youthful manpower. To this end, there will be an increase in the quota of students enrolled for graduate study, with a pilot program of "postdoctoral" research work. A group of "postdoctoral" mobile stations will be set up, to make it easier for research teams to progressively increase the number of their personnel who obtain degrees. A young S&T workers fund will be established at once to subsidize and reward the early emergence of S&T personnel under the age of 35 who have innovative capabilities.

Yan Dongsheng said that the CAS will adopt certain measures designed to speed up the flow of talent and scholarly thought: the measures will include arranging a system of visiting researchers, setting up special research funds, and defining and establishing a group of research institutes and laboratories which will be open to the entire nation.

Yan Dongsheng went on to point out that a retirement system for S&T personnel will be implemented. Retired S&T personnel will not again hold office in party or government, or in academic leadership. There will be encouragement and support for them to write books setting forth their theories, summing up their experiences in scholarly research, to foster and recruit young talent. At the same time, a group of S&T personnel will be mobilized for transfer into management positions. The compensation for these management personnel should not be less than the average for S&T personnel in general; in addition, those who perform well, those whose work is outstanding, should be rewarded handsomely.

12625
CSO: 4008/214

NATIONAL DEVELOPMENTS

CAS OFFICIAL CONDEMNS RESEARCH INBREEDING

Beijing GUANGMING RIBAO in Chinese 21 Dec 84 p 1

[Article by Zheng Haining [6774 3189 1380]: "'Inbreeding' in Scholarly Research Hinders Young People 'Standing Out;' CAS Vice-Chairman Zhou Guangzhao Points to an Evil in Our Development of S&T Personnel; Universities and Research Organizations Should Not Retain Students They Have Trained, but Release Them to Other Units so as to Understand Different Viewpoints, Compete Academically, and Try New Ideas and Develop"]

[Text] Zhou Guangzhao [0719 0342 0664], the noted Chinese physicist and Vice-Chairman of the Chinese Academy of Sciences (CAS), told visiting journalists today that in scholarly research, "inbreeding" is a major reason why China's young research personnel do not easily "stand out."

Zhou Guangzhao said that the so-called "inbreeding" in scholarly research can be blamed on the students' units and teachers, who generally prefer students to remain in those units as the teachers' assistants, and after these students are working for their teachers, they then in their own turn like to have their students staying with them. This sort of "inbreeding" is frequently found in research or academic units, with the result that their academic viewpoints, research methods and research contents are basically identical. Where there is "inbreeding," thought is very restrained, and some people are often narrow in their thinking and lack the spirit which can bring forth new ideas. They may regard their teachers' views as the correct ones, perhaps perfect, but even when they do have ideas of their own, they do not express views counter to those of their teachers. Because they are their teachers' students, it is not easy for those who are in academic positions to surpass their teachers and 'stand out'. At the same time, while there may be a difference in qualifications between them, the difference is not often great.

Zhou Guangzhao noted that this kind of "inbreeding" is most frequently noted in China among the 45 to 55 year old group of researchers. One important reason for this is that there is a relatively small number of scientists with a high "degree of fame". It also happens that in some research units, after the retirement of an older generation of scientists, there will appear the phenomenon of a "leaderless group," lacking notables, with the standard for all being set by middle-aged scholars in authority. The urgency in this situation lies in the need to fully assign this generation of researchers positively; in

order to do this, part of them must be encouraged to continue involvement in academic research, while there must also be an expansion of researchers exploring newer and more productive channels. At the same time, the best of our research backbone must be sent to organizations which are technological leaders; this will replenish all ranks and all fields. Where there are genuinely important results and a relatively high level of scholarship, no matter how weak or how strong their credentials, all must be promoted immediately to the higher ranks of research personnel.

Zhou Guangzhao emphasized that in developing young researchers, it is necessary to adopt methods different from those of the past. Universities and research organizations should in general cease the practice of employing students that they themselves have trained, but should instead release them so that they may go to other units. This way, they will understand dissimilar viewpoints, cooperate with people who received their training elsewhere, compete academically and mature professionally, try out new ideas and develop them. In the future, some model laboratories could be established, which would be open to the public and serve the entire nation. Moreover we could adopt the "S&T mobile shops" method, in order to promote personnel mobility. We should consider this as similar to the case of mankind prohibiting close relations from marrying, for in scholarship, too, "inbreeding" is a very damaging thing. Practice has demonstrated that this kind of method causes fields to stagnate and not go forward, causes scholarly thought to age, gives rise to the evil of arranging personnel by seniority, hinders young people from "standing out," and results in other evils.

Zhou Guangzhao knows that in the future, not all of those who are sent abroad for school or advanced study should be young people who are recent college graduates. The backbone we develop should be about 25 years of age. They can be people who received their doctoral degrees in China, and from those young researchers who have matured professionally by spending some time in a work station, some outstanding personnel should be selected for a number of years advanced study overseas. This will allow them to achieve a certain scholarly position internationally. This way, after they return to China, they can easily become outstanding scholarly leaders. In order that young researchers "stand out" quickly, Zhou Guangzhao emphasized that in units which have the proper conditions, there should be organized a "young shock brigade." This would have the support and aid of the older generation of scientists, and would have young researchers at the center. It would supply these with important research missions to carry out, and give them still greater independence and self governance.

12625
CSO: 4008/214

RESEARCH ORGANIZATIONS INVIGORATED BY PAID CONTRACT SYSTEM

Beijing RENMIN RIBAO in Chinese 31 Jan 85 p 3

[Article by Chen Zujia [7115 4371 3946]: "Paid Contract System Invigorates Research Organizations; This is Verified by the Practice of Beijing Municipal Research Units"]

[Text] Last year, the research units reporting to the Municipality of Beijing initiated a reform of their S&T research system, implementing a system of paid contracts for research; this has obtained notable results. The 23 research institutes trying out the paid contract system show the following 1984 research work results compared to the same for 1983: the number of projects increased by 35.6 percent, with a 33.5 percent increase in results; the amount of results which were put into application increased by 51.2 percent; there was an 80.8 percent increase in gross income, with net income reaching 12.99 million yuan, and a 30 percent decrease in operating expenses.

Beijing has 80 research organizations reporting directly to it, of which 51 units implemented the paid contract and research responsibility system last year on a trial basis. All the municipality's research units last year were entrusted with a total of 1,274 projects for research and trial-production by production enterprises, an increase of 61.7 percent over 1983. 396 projects were successfully transferred to enterprises, an increase of 162.3 percent over the previous year's total. During the same period, some research institutes started up joint technical operations with production enterprises, establishing over 70 joint systems for research and production. Besides this, eight units, which included the Electro-mechanical Research Academy, the Labor Protection Institute and the Nutrition Resources Research Institute, set up long-term and stable cooperative relationships with production enterprises.

Can implementation of a paid contract system influence the accomplishment of the national research program? According to Chen Shengwu [7115 4939 2976], implementing such a system cannot impede the accomplishment of our national research program, but on the contrary can possibly promote it. Last year, Beijing completed 86 percent of the research projects passed down from the national and municipal levels, surpassing the level of attainment of previous years. The Beijing Radio Technology Research Institute produced on schedule a digital multimeter, for which it received a citation from the National Defense Science, Technology and Industry Commission. The Beijing Powder

Metallurgy Research Institute accomplished the methods and instruments for reduction oxide-measurement dating in metallic powders, attaining the international standard for the first time. Moreover this project was specifically not entrusted for compensation.

A few days ago, Chen Shengwu told reporters that in order to ensure fulfillment of the national research mission, Beijing has adopted two principle measures: the first is that when concluding a general contract, the first clause which stipulates the explicit responsibilities of the research unit should also note that the unit will carry out research projects handed down to it from national or municipal authorities; the second, that when research units and their personnel are evaluated, the completion of the national program's mission should be a vital standard of evaluation, and unless the program mission is completed, no awards will be presented.

12625
CSO: 4008/214

NATIONAL DEVELOPMENTS

PAID CONTRACTS FOR SCIENTIFIC RESEARCH BECOMING GENERAL TREND

Beijing RENMIN RIBAO in Chinese 13 Dec 84 p 3

[Article by Li Guoguang [2621 0948 0342] and Fan Qiongying [5400 8825 5391]: "Implementing Paid Contracts for Scientific Research is Becoming the General Trend"]

[Text] Science and technology daily are becoming a stronger, more independent field, a growing force for society's development, and an important societal resource. In order to regulate the relationship between S&T and production, and between the various S&T branches, the system of paid contracts for research is coming along at precisely the right time.

Worldwide, the system of contracting for scientific research has existed for several decades. The first such system emerged in the United States, and by World War II the contractual research system had become an important part of U.S. S&T management. In time, the contractual system spread to other nations. The Soviet Union adopted it wholly, and in 1961 a conference of Soviet department heads issued "On the Implementation of Economic Accounting for Departmental Research and Planning Organizations." At the present time the Soviet system is still being developed and perfected. Around 1970, the Eastern European nations also began to gradually implement a contractual research system. This promoted the integration of research with economic departments, changed the S&T professions' wasteful reliance on national budgetary allocations and on methods handed down from the national government, and established a new system whereby the unit benefitting from the research would be the principle channel for allocations. For example, after Hungary's new economic order was put into effect in 1968, the Budapest Steel Research Institute's research expenses for an entire year were 80 percent from contracts concluded with factories and only 20 percent from all governmental organizations. Industrial research institutes in some Western European countries operate under a somewhat similar arrangement.

At the beginning of 1981, China formulated a new guiding principle for the development of science and technology. The most important component of this principle was that science and technology should serve first and foremost the development of China's economy. Therefore, it was imperative that scientific research strengthen its research on production technology, strengthen industrial and agricultural production's first line of technological development

and the work of popularizing the results of research. China's research institutes, particularly those engaged in applied research, should be geared to the needs of the economy, to applications and to society. This must be regarded as the single greatest strategic change in China's scientific and technical work.

In order to implement this change, it is essential that there be a series of vital reforms in S&T management. For more than 30 years, China's system of S&T management has been largely modeled on a high degree of concentration. The major disadvantage of this model is that "eating from a common pot" makes it impossible to effect positive transfers of research personnel. A continued reliance on the "provision system," whereby the means are handed down, would mean there would be no way of carrying out this strategic change.

During the past few years, in order to change this kind of management system which fetters scientific labor, several research units in Beijing, Shanghai, Anhui, Hunan and other areas implemented the contractual research system on a trial basis. This was done under the influence of the production responsibility system practiced in rural areas, and given impetus by the continual reform of the urban economies. The trials of the contractual system have had gratifying results, and have furnished experience for a total reform of China's system of research management. It is time now to give serious attention to summarizing the experiences of these trials, and moreover consult the experiences of foreign nations, so that the great majority of China's S&T research institutes, including the majority of those in academic institutions, will fully implement the contract system, and thereby cause economic accounting to enter the realm of research and development. It is demonstrated fact that the contractual research system can bring research institutes and production units into a closer relationship, and can bring together more closely those who undertake research projects and those who make use of them. It can also shorten the research period and increase the quantity of results, as well as speeding up the spread of their application. Some of China's research institutes have also demonstrated in practice that the adoption of the paid contract research system can vastly improve research efficiency and enhance the relationship between S&T and production. In the fourth quarter of 1981, Beijing instituted a contract system on a trial basis in the research institutes of 20 industrial units, which gave these institutes increased motivation, intensity and vigor. These 20 institutes showed a 20 percent increase in their results, while institutes not included in the trial showed a 6.2 percent decrease. The spread of application of results increased by 21 percent in the trial institutes, compared to only a 12.7 percent increase for thost institutes which were excluded from the trial. The income of the 20 included institutes increased by 77.9 percent, and there was a 41 percent increase in the transfer of results. The number of personnel required per project decreased from 11 people to 6, and the utilization rate of instruments and equipment increased from one-half to one-fold. These experiences also illustrate that the adoption of a paid contract system for research can attain many forms of rewards, positive transfer of personnel, and can promote the growth to maturity of manpower.

These experiences are of particular importance for the research institutes and research offices of academic institutions. Academic institutions are an important front army in China's scientific research, possessed of abundant technological strength. However, because of restrictions applied in the past by departments, funds for research have not amounted to what was pledged, and this has seriously affected the development of scientific research. This has been especially true for some comprehensive or multi-disciplinary industrial universities, because some research topics were inappropriate for the needs of the responsible ministries and commissions. This has made it difficult to carry out the research. But where a paid contract system has been implemented, the research of academic institutions has been invigorated. An example of this is the Beijing Industrial University's Radio Equipment Research Office, which has in the past encountered research funding difficulties and fallen behind in equipment due to restrictions placed on it by departments. After implementing a paid contract research system, they were able to rely on contractual income and purchase advanced instruments and equipment, which enabled the office to cope with research work of a high degree of difficulty. With a staff of only ten people, this research office from 1978 to 1983 developed a total of nine research projects, among which were three that received national prizes for inventions. Another example is the Department of Mechanical Engineering, which concluded a wide ranging contract with economic departments. In carrying out developmental research, they not only increased their research funding, purchased equipment for use in research and teaching and improved teaching conditions, but they also broadened their special field, acquiring newer teaching materials, and polishing the teachers' performance, helping to improve the quality of teaching.

Of course, China's paid contract research is in a trial phase, a very imperfect system with many new problems which demand solution. Just one example of these problems is that of calculating a standard level of economic benefit which is to be derived from research; another is the problem of how the income from research should be distributed. There are others, but we believe that all of these problems will gradually find a solution during the course of putting the system into practice, and the paid contract system will become a new research management system.

12625
CSO: 4008/214

NATIONAL DEVELOPMENTS

NEW TECHNOLOGIES, INDUSTRIES DEMAND IMPROVED ECONOMIC MANAGEMENT

Beijing RENMIN RIBAO in Chinese 18 Jan 85 p 5

[Article by Zhou Shulian [6650 0647 5571]: "Newly Emerging Science And Technology And Economic Management"]

[Text] The Chinese people are now in the midst of a struggle to realize the strategic objectives proposed by the Twelfth Party Congress. The principal objectives of the Sixth Five-year Plan have been accomplished ahead of schedule, and China's financial situation has improved steadily. The Third Plenary Session of the Twelfth Party Central Committee has drawn up a blueprint for the total reform of our economic system which places its emphasis on the urban areas. Therefore, we have the fullest confidence in our mission of quadrupling the total output of our industrial and agricultural production by the end of this century. However, we cannot ignore the reality that we will doubtless encounter difficulties in achieving this strategic objective. In order to overcome these difficulties, we must give our fullest attention to using and developing new technologies, and to strengthening economic management.

The use of new technologies must improve economic management. At the same time, the use of new technologies will also provide the necessary conditions for improving and strengthening economic management. The histories of China and other nations has proven that modern new technologies and industries cannot develop spontaneously. The way in which economic management is used can be of great importance and even decisive in determining whether new technologies and industries develop healthily and speedily.

Formulating Countermeasures With a Scientific Foundation.

At the present time, various nations are paying considerable attention to formulating ways of coping with the new technological revolution. Viewed from the standpoint of various nations' histories, these countermeasures, whether correct or not will have a massive influence on the future development of technology and economics. For example, England after World War II chose to have such departments as coal mining, railways, iron and steel, etc., serve for the long term as the industrial "high ground." They failed to follow such technological intelligence as to the new technologies' rapidly developing situation, so as a result they fell behind other nations. Japan after the war initially imported a large quantity of mature, traditional, industrial

technology, and by the middle of the 1960s they had attained the world's level of advancement, then they started to move into the newly emerging technical areas. In less than 20 years they had attained an advanced level in a majority of the most advanced technological fields.

In order to accelerate the development of newly emerging technologies, and bring their positive use into full play, we must do well at the vital task of economic management. Specifically we must lay a foundation in technological and economic development regulations, setting out from our national situation, formulating the correct policy, and solving various strategic problems.

First, employ the development of new technologies in those places where they will be of the most importance, and handle correctly the relationship of opening up the new technology with realization of strategic objectives. At the present time, China is several decades behind other nations technologically, confronted not only with the challenge of the new worldwide technological revolution, but also the responsibility of completing the last technological revolution. Under these conditions, in what areas China chooses to apply new technology presents an even more complex problem. Obviously, we cannot pass over those stages of development which are essential, but we also cannot blindly follow the lead of others, telling our people in every instance to travel the roads already laid out. In all fields, we have both the possibility and necessity of leapfrogging some traditional stages of industrial development, choosing the more advanced S&T achievements and developing new technology. For example, in the engineering industry, we can unify mechanical and electrical technologies to develop electro-mechanical products; when setting up communications we can choose optical fiber digital communications and satellite communications technology; in the technological processes of the metallurgical and chemical industries, we can choose computer controlled technology, etc. It should also be obvious that the new technologies we use and develop should be merged with the modernization goals we wish to attain by the end of this century, centering on and subordinated to these goals, and serving them.

Second, correctly handle the relationship between traditional and newly emerging industries. At present, in the United States, Japan and several Western European nations, such traditional industries as steel and automobiles are already tending towards stagnation or decline, and are referred to as "sunset industries." But in China these traditional industries will still be developing for a rather long time, still a major part of our national economy. For this reason, we must positively apply new technology to transform and develop traditional industries, and even apply the new technologies to improving the development of our strategic points of emphasis, e.g., agriculture, energy, transportation, communications, science, education, etc. New technologies, in serving traditional industries positively are not only needed to transform and develop traditional industries but also are needed to serve the traditional industries themselves. This is because the newly emerging industries in general grew out of the traditional industries' foundation, and it was only where the traditional industries were fairly well developed that the newer industries were able to emerge and develop smoothly. Naturally, one must also note that the development of the newer industries was not only restricted by

the traditional industries, but also by the level of development of science and technology. At the same time we are using new technology to develop traditional industries, we must also be in line with needs and possibilities, positively establishing and developing new industries. This is a requirement for realizing the modernization of our industrial organization, and also a requirement for transforming traditional industries and fully bringing new technologies into positive use. We must strive to increase substantially the proportion of newer industries in our economy within a decade or two.

Three, handle correctly the relationship between imported foreign technology and our domestic research, development and production. The exchange of science technology between nations is a widespread pattern in improving development of the forces of production, and the importation of advanced foreign technology is a necessary measure and effective condition for stepping up the pace of China's economic development and modernization. As for developing newly emerging technologies and newly emerging industries, imported technologies are needed even more. By doing it this way, we can fight for time, speed up use, save investments and increase benefits. Because international competition is extremely intense, and technological progress extremely rapid, we must therefore select a variety of ways and models, including Chinese and foreign joint investment and management, foreign commercial unilateral investment and management, compensated trade and cooperative production, as well as conducting special zones, opening up coastal cities to traffic, etc., in order to speed up the use of foreign investment and the importation of advanced technology. While we are paying attention to importing, we must also pay serious attention to developing our own domestic research. This is essential not only to develop China's science and technology, but also to digest and assimilate foreign technology. Importing foreign technology in combination with domestic research, development and production is certainly contradictory, and this contradiction must be handled properly, coordinating their relationship, and adopting appropriate measures to safeguard domestic research, development and production.

Fourth, choose correctly the new technologies and new industries which will be emphasized in development. In developing new technologies and industries we should choose a policy of "limited goals, stressing the main points." What is meant by stressing the main points is not to take account of several aspects concurrently, but to set out from the national economy as a whole, according to the requirements of the national economy's planned proportionate development, grasping firmly the main links between them. Setting out from China's present and future realistic situation, we should focus on developing the information industry, while at the same time putting materials science, bioengineering, nuclear technology and marine engineering in positions of importance. However, we must pay attention to those lessons we drew from our last attempt to open up new technology, namely to avoid the "completely catch up and overtake," and "our own system;" we must guard against the tendency to have requirements which are too high and too pressing.

In applying and developing new technologies we must also give the fullest attention to economic benefits, and to intellectual development. We should go through all types of management methods, coordinating the development of technology, economy and society.

The System of Economic Management Should Suit What Is Required For Developing New Technologies.

The new technological revolution that is just now emerging worldwide not only poses a challenge to China's economic development, it also challenges our system of economic management. China's socialist system is founded on a system of public ownership of the means of production, carrying out a planned economy, and a planned production economy, with the result that in developing science and technology, we have some great advantages. This is demonstrated by the significant achievements made by the S&T profession since liberation. However, under our kind of excessively concentrated, unified system of management, enterprises and research units opening up the application of new technology positively have encountered restraints. These restraints have hindered bringing socialism's advantages into full play, and have been harmful to the development of new technologies and industries. For this reason, reform of the system of economic management is an urgent requirement for developing new technologies.

Compared with other economic activities, opening up new technologies has a great many special characteristics. First, because this is a kind of developmental work, it carries a greater risk. Second, new technologies, from the initial research to the application of research results in production, must pass through many stages and longer time period, so the benefits gained require a longer period of time. Third, new technologies in general are knowledge intensive, relying on brain power, and requiring making maximum use of the knowledge and work of intellectuals. The development of many new technologies also requires the expenditure of larger amounts of funds. Fourth, under our present, illogical system of pricing, the enterprises and research units which are opening up the application of new technologies possibly do not derive the profits that they deserve, but they do benefit other units and the whole of society; therefore, the allocation of the benefits from new technologies is a complicated issue. Fifth, putting new technologies into application involves many departments and units, including enterprises, research units, academic institutions, etc., so it also involves both our system of economic management and our system of education management. In summary, when reforming the system of economic management, we must make a full study of these several characteristics and others, so that the economic management system assures and promotes the development of new technologies and enterprises in many ways.

That enterprises take advantage of popularizing the new technologies is critical, therefore in the reforms it is necessary that the enterprises which do exploit and open up the new technologies have a high degree of enthusiasm and complete independence of operation. Large enterprises in the economically developed nations generally have their own research and development organizations, which devote their full attention to finding ways of applying new technologies, and this is a major reason why they are technologically and economically developed. Some of China's larger state-run enterprises also have the conditions which are favorable to developing and exploiting new technologies, so we should choose all necessary measures, bringing their enthusiasm and latent potential into full play. In research, development and application of new technologies, under the unified leadership of the nation's concerned

departments, we should permit the necessary independence of operation. For unless this is done, their caring will die and their enthusiasm will be stifled, putting them in a completely passive position in competition, and thus unable to become backbone enterprises in fact as well as in name, taking full advantage of the people's ownership and leading role. Small and medium-sized enterprises also have a role to play in finding applications of new technologies, and we should make sure that they are fully involved. In order to develop new technologies, we should in the same way make sure that we give full attention to the role and S&T strength of research units and academic institutions. It is necessary to reform the S&T and educational management systems, and choose the correct policy measures. Increase the independence of operation of research units and academic institutions, fully mobilize their enthusiasm, and link them closely with enterprises, promoting the research, development and application of new technologies. A great many nations, in the course of developing such new technologies as electronic computers, put a total emphasis on the links between government, research units, enterprises and universities. In China, there are some localities and departments which have similar experiences which merit study and summarizing. There should also be implemented a system for the compensated transfer of research results.

In the reforms we should adopt a set of special policies and measures which are concerned with the development of new technologies and industries. (1) To resolve the state of affairs of decentralized departments and localities, the method of inviting and submitting bids should be adopted, or else adopt joint stock company arrangements, setting up a trans-departmental, trans-locality enterprise or integrated complex for developing newly emerging technologies. These enterprises or integrated complexes will cast off management terms currently in effect, from national stipulations and conditions, and practice independent accounting, with sole responsibility for profits and losses. They will receive special subsidies and the necessary independence of operation, including permission to have special foreign exchange and funds, and the authority to form foreign connections. (2) It should be possible to set up special investment companies for newly emerging technologies, to sell stock shares to local enterprises and individuals, and according to the amount invested, share in certain technological results or have priority in being supplied a certain portion of the product, and receiving dividends at set periods. (3) There can be pilot enterprises similar to the United State's "Silicon Valley," a small economic zone where there is a concentration of newly emerging technologies and enterprises, and in which cities having the proper conditions can recruit S&T personnel strictly according to their qualifications, to develop newly emerging industries. Within the small economic zones S&T personnel can move about freely, with enterprises, research units and academic institutions all establishing close cooperative relationships. They can also put into practice policies which are favorable in attracting both domestics and foreign investment in the construction of new plants. (4) In developing new industries we must follow an unrestricted road, so that we can both import and export. Whether new industries are jointly owned with foreign capital or independently owned and operated, they should receive preferential treatment, and their profits should be accorded legal protection. It should also be possible for both individuals and collectives to develop new technologies and operate new enterprises.

Some Questions For Further Study

In order to reform economic management, and encourage the development and application of newly emerging technologies, there are a great many questions which require further study. For instance, there should be a study of the patterns of technological development (including the evolution of the structure of technology) and the development of enterprises (including the evolution of the structure of enterprise). There should be research on the interactions between technological development and enterprise development and the factors which hinder that development. It is only by thoroughly understanding these patterns that we can formulate and perfect ways of coping with them. When these ways of coping have evolved from plan to practice, then we will be properly handling the relationship between newly emerging technologies and traditional technologies, between newly emerging enterprises and traditional ones. Moreover, in order to understand these patterns, it is necessary to study the history of each country's technological and enterprise development summing up the lessons of their experience. If we are to handle properly the relationships between newly emerging and traditional enterprises, then we must set out from China's specific situation, and make a thorough study of China's basic national conditions and those factors which restrict its technological and enterprise structure. We must study the evolutionary trends of national conditions and their influences. We must study the characteristics and developmental regulations of our system of socialist economic management, and study the interactions between the economic management system and technological development. In order that the economic management system be capable of protecting and improving the smooth development of new technologies and enterprises, the system must aid in strengthening the nation's unified program and collective use of limited manpower, materials and resources. It also must be beneficial to enterprises which have complete independence of action, making the maximum use of their initiative and enthusiasm. This would best be done by exerting some effort to summing up our historical experiences, searching for those objective factors which are chiefly restricting the evolution of the economic management system. We must find the natural laws which determine this, and master the correct application of those laws.

12625
CSO: 4008/214

APPLIED SCIENCES

SEISMIC TELECOMMUNICATIONS NETWORK ESTABLISHED

OW080941 Beijing XINHUA in English 0908 GMT 8 Feb 85

[Text] Chengdu, 8 February (XINHUA)--Six regional earthquake surveillance centers have been built over the past 8 years in China's seismically active areas, according to the National Seismological Bureau today.

The centers are equipped with 140 unmanned surveillance stations, which work automatically round the clock, monitoring seismic activities and transmitting information to the centers for processing by electronic computers.

The centers are in Shanghai, Shenyang, Beijing, Lanzhou, Chengdu and Kunming, which cover the bulk of the country's territory.

CSO: 4010/142

APPLIED SCIENCES

PRC TO COMPLETE GEOLOGICAL MAPPING OF XIZANG

OW261816 Beijing XINHUA in English 1646 GMT 26 Apr 85

[Text] Ihasa, 26 April (XINHUA)--A geological team left here today for Gartogfu in west Tibet, the last spot yet to be surveyed on China's land of 9.6 million square kilometers.

It will complete the drawing of a national geological map with a scale of 1:1,000,000, a project launched shortly after the founding of New China in 1949.

Gartogfu, covering a total area of about 100,000 square kilometers, is on the western part of the Tibet Plateau, about 5,000 meters above sea level.

The survey will be completed in mid-August, according to the Tibet Autonomous Regional Geological Bureau.

CSO: 4010/142

APPLIED SCIENCES

PRC PRODUCES AERIAL MAGNETIC SURVEYING SYSTEM

OW171351 Beijing XINHUA in English 1149 GMT 17 May 85

[Text] Guiyang, 17 May (XINHUA)--China has produced a high-precision aerial magnetic surveying system and put it to test in the central part of Guizhou Province.

Later this year, the system will be used to study the geophysical properites of Hailar in Inner Mongolia and an area comprising parts of Sichuan, Shaanxi, and Hubei.

The system was produced by a unit under the Ministry of Geology and Minerals researching use of the earth's magnetic field as an aerial survey tool. It will be especially valuable in surveying for oil in areas formed by marine sedimentation, such as Guizhou, Yunnan, Sichuan, Guangxi, and Hunan.

CSO: 4010/142

APPLIED SCIENCES

CHINESE ACADEMY OF SCIENCES DEVELOPES, USES MICROCOMPUTERS

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese Extra No 1, 29 Apr 84 p 12

[Article: "Microcomputer Use at the Chinese Academy of Sciences"]

[Excerpts] For Data Acquisition System

Data acquisition analysis systems is an important area in microcomputer applications. A microcomputer controlled data acquisition analysis system can replace complex labor intensive tasks, its processing speed is fast, its precision is high, and it is a technique which can be used for data acquisitions at sea, in the field, and some work sites. To suit the needs of various applications situations, the Institute of Acoustics of the Chinese Academy of Sciences developed a multiple model, having different sampling frequency, different form data acquisitions analysis system, sampling frequencies from hundredths of a Herz to several million Herz, recording modes which can use direct storage or simple interface input, and in which acquisition can be transient or continuous.

Currently, internationally, comparative prices of data analysis systems (FFT signal analyzers) and microcomputer are very dear, and China's needs become greater every year; yet microcomputers have only digifax converters and cannot carry out overall signal analysis. Although FFT operations can be implemented using software, the speed is too slow. The data acquisitions analysis systems developed using microcomputers they used can both carry out high speed FFT processing and can also carry out signal analysis. The DPS085 data acquisitions analysis system is one example.

The DPS-85 data acquisitions analysis system is made up of a Z80 CPU, 64K RAM, floppy disk drive, D/A and A/D converter board and high speed processing FFT board, sampling frequency can reach 200 kHz/sec, 1024 dot processing speed is 500 ms. The system has a statistical analysis and data analysis software library. In addition to data acquisitions analyzer, the system also can be used as a microcomputer.

For Intelligent Remote Controlled Sound Tracking

The Wuhan Rock Mechanics Institute of the Chinese Academy of Sciences has developed an intelligent remote controlled sound tracking system using a

TRS-80 microcomputer which provides a new device for researching micro-fissures occuring inside rocks. The measurement results in use are satisfying.

Remote controlled sound tracking is a technique for studying microfissures inside rocks. When microfissures occur inside rocks, people cannot see them from the outside nor can they hear them. This presents difficulties in research work. The Wuhan Rock Mechanics Institute used a microcomputer to combine organically such technologies as remote measuring, automatic control, and reporting time and make a complete analytical system to carry out comprehensive analyzis of the microcosmic fissures inside rocks. When microfissures occur in rocks, the remote controlled sound tracker can monitor the microfissure situation and automatically record such parameters as microfissure sound information, rock shift, and strain and automatically draw curves and pictures and through analysis and research can quickly know the fissure situation, and can also print out the results. Development of this device resolve the problems of the expense of long-term monitor recording, difficulty of organizing materials, and the difficulty of analysis, thus it is an ideal sound tracking device.

This microcomputer intelligent remote sound tracking device can serve for researching the sound characteristics and dynamic properties of rocks and other materials and thus its applications can be extended to mining engineering, mine roof cave-in forecasting, earthquake noise monitoring and other types of engineering which must have fully automatic control, remote sound information, intelligent processing, recording, and warning. The system can be used in the lab for testing and can also be used in the field for test jobs. This item has been evaluated highly at international academic conferences.

8226
CSO: 4008/1004

MICROCOMPUTER APPLICATIONS IN LIAONING SUMMARIZED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese Extra No 1, 29 Apr 84 pp 9-10

[Article: "Microcomputer Applications in Liaoning"]

[Excerpts] For Weather Forecasting:

Improving the accuracy of weather forecasts is an important topic which concerns all sectors of the national economy, and is of primary importance especially to agricultural production and water conservancy construction. To make quantitative numerical weather forecasts which conform to actual circumstances, the Yingkou Meteorological Station used computer technology in meteorological work to develop medium and short range weather forecasting research with very satisfying results.

The methods used in weather forecasting in the past were to analyze weather maps and make calculations based half on theory and half on experience, thus the accuracy of the forecasts was not high. Analysis of materials shows that it requires 60,000 people simultaneously solving fluid motion equations to make weather forecasts which conform to the actual weather situation, and since this is clearly difficult to realize, it limits improvements in the accuracy of weather forecasts.

For this reason, last year the Yingkou Meteorological Station used a computer for weather forecasting with satisfying results. They used a TRS-80 microcomputer and U.S. MOS weather forecasting methods for medium and short range weather forecasts. In 21 day short-range MOS weather forecasts, the accuracy rate was 100 percent; in medium- and long-range forecasts in just 10 days they completed computer processing of interrelated factors of 200,000 pieces of data and the computer provided answers to medium- and long-range equations for rainfall and temperature for 3 to 8 months satisfying the demands of weather analysis.

For Controlling a Plastometer

The automatic ganji [3927 1015] plastometer equipped with a M6800 microcomputer which was developed by the Dandong Electronics Institute for the Coal Academy can measure the plasticity and fluidity of coal.

Plasticity is one of the important norms of coal coking and using this device to measure the plasticity of coal can automatically determine, record and print out the hyperthermic and constant temperature parameters. Testing coal with this device can make it possible to replace inferior coal with superior coal and thus save on energy resources as well as reduce shipping coal back and forth. The [illegible] device's degree of temperature control automation exceeds the level of similar Japanese devices.

For Automatic Management of Long-Distance Phone Calls

To accelerate the speed of processing long-distance telephone calls and improving accuracy, the Shenyang Municipal Long-Distance Telephone Bureau used a TP801 single-board computer to develop an automatic long-distance phone call billing and sorting system which greatly improved the level of automation of long-distance phone calls and can strengthen management of telephone equipment and users. This system automatically records the telephone number of the origin and the start and stop time of each telephone call, then calculates the tariff on the basis of the called city's rate and duration of call. This information can be called as needed and automatically printed out. In addition, the system can also automatically compile statistics on the volume of flow between the destination and city of origin of long distance calls and the direction of flow and give the calling rate and connection rate. This system of automatically billing and sorting long distance phone calls by computer can save 200,000 yuan over the previous mechanically controlled billing equipment and reduce by 10-15 persons involved in manually sorting, thus there are clear economic and social benefits and it is worth promoting.

For Traffic Flow Analysis

The Dandong Electronics Institute developed a completely automatic traffic flow analyzer using a TP801 single-board computer for the Liaoning Provincial Highway Management Bureau for surveying volume of traffic flow and theoretical reserach in traffic engineering. This device can automatically recognize vehicle type, record automobile flow, and can distinguish whether the vehicle is travelling upward or downward, is unloaded or loaded, and vehicle speed. The device analysis precision is 90 percent, counting precision is 90 percent. Carrying out traffic flow surveys and traffic engineering theoretical research with this device not only can save manpower, but more importantly, can provide reliable data for investment in highway construction and improving construction quality, thus it is worth promoting.

8226
CSO: 4008/1004

APPLIED SCIENCES

NEW DOMESTIC MODEL HXP-1 KEYBOARD DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 23 Jan 84 p 6

[Article: "New Domestic Keyboard Comes Out"]

[Text] With the cooperation of relevant units, the Beijing Wired Radio Plant recently produced new domestic keys and a keyboard--Red Cloud [Hongxia 4767 7209] 1 model keys (HXJ-1) and Red Cloud 1 model keyboard (HXP-1).

The Red Cloud 1 model key is a mechanical key developed on the foundation of drawing on foreign advanced products. The maximum key press force is 85g, contact resistance is 0.2 , flutter time is 2ms, life is 1×10^7 key-presses; current mechanical contact tests have already exceeded 15 million times. In terms of primary performance norms it has reached or come close to the level of similar products from abroad. To resolve the problem that domestic keys did not feel good and were unattractive, through repeated trials, they adopted new secondary plastic injection technology to make the keytops attractive and large, and the characters on them will last a long time without being worn off. User reaction after use has been good.

On the foundation of this high quality key, this plant is also test producing the Red Cloud 1 model keyboard. This is an encoding keyboard containing 64 graphic character function keys and 3 auxiliary keys, output uses 26-line ribbon cable, and also has auxiliary lines. It comes with or without a key-board housing.

Both products recently passed appraisal.

8226
CSO: 4008/1001

MANUFACTURING OF 500 UNITS OF BCM-IIIA MICROCOMPUTER IN 1984 PLANNED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 23 Jan 84 p 1

[Article: "BCM-IIIA Microcomputer Goes into Batch Production"]

[Text] The BCM-IIIA microcomputer received from the Beijing Institute of Computer Technology for production by Beijing Computer Plant No 3 passed appraisal after undergoing batch trials, and went into batch production at the end of 1983.

The BCM-IIIA uses the Z-80A as CPU and is a multifunction 8-bit microcomputer system which can be broadly applied in scientific computations, data processing, process control, detection, and routine management.

The Beijing Computer Plant No 3 made some improvements to the original design to suit large batch production and facilitate user maintenance and expansion. They used a completely independent system for the chassis, the back of the chassis is open and the drive and the mainframe board and interface board are separate. CHE file and PRTE file were added to the original software. Software workers also developed special software for the system, including print software packages of several languages operating with the support of the CP/M operating system.

This year the Beijing Computer Plant No 3 plans to produce 500 units of this microcomputer. Each system will include computer, two 8-inch floppy disk drives, printer, standard ASCII keyboard and 12-inch monitor. The price will be about 30,000 yuan per unit and users will be provided at no charge a system which can display and print Chinese characters.

8226
CSO: 4008/1001

APPLIED SCIENCES

CHINA'S FIRST PCM TECHNOLOGY FORUM

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 23 Jan 84 p 6

[Article: "China Holds First PCM Technology Forum"]

[Text] Last November China held the first national computer PCM (card compatibility) technology forum. Nearly 50 representatives from throughout the country participated, and over 20 papers were read, mainly involving the IBM and DEC type factory computers and principles of other PCM machine system configuration, PCM machine compatibility testing methods, and examples of PCM technology applications.

At the meeting, representatives carried out enthusiastic discussion of the definition of compatibility, division and testing methods of PCM compatibility levels, applications of PCM technology in various areas and specific measures and methods of implementation for China's adoption of the PCM path. Everyone felt that the important computer producing countries in the world today will adopt the PCM path for developing their computer industries. This is the case with many U.S. companies as well as Japan, Western Europe and the Soviet Union.

Beginning with the DJS-100 series we have also begun to take this path, knowingly or unknowingly, and have now developed medium, large, micro and giant computer areas and have made real achievements. Facts show that PCM technology is also a better way of developing our computer industry.

The central idea of PCM technology is card compatibility, and the principle stipulated in the IBM 370 operating system can be adopted as a definition of compatibility. PCM machines not only should satisfy the demands of compatibility, but also should come close to or surpass the norms of the target machine in terms of relative performance. Currently, the IBM company's products have become the virtual standard, and taking the PCM path has become a world trend. PCM technology has broad applications prospects in all areas.

8226
CSO: 4008/1001

APPLIED SCIENCES

GENERAL PURPOSE COLOR GRAPHICS, CHINESE CHARACTER PROCESSING SYSTEM DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 23 Jan 84 p 6

[Article: "Beijing Computer Institute Develops BCT-4: General Purpose Color Graphics and Chinese Character Processing System"]

[Text] The Beijing Computer Technology Institute recently developed the BCT-4 general purpose color graphics and Chinese character processing system. This new system passed technical evaluation at the end of last year.

The new system is based on the BCM-3 microcomputer system and uses the Chinese-Western language compatible CP/M2.2 operating system. In terms of hardware, a color display has been added to the original BCM-3 basic devices; in terms of software, it includes two parts: a general purpose word processing software package and a plane color graphics software package.

The new system has four outstanding features. 1. It uses computer assisted input code--CAI code--and maintains ease of encoding replacement. 2. It has general purpose word processing function, implements closed invertible loop of internally stored and externally stored information providing the user with a large capacity editing buffer. 3. It has color graphics function. 4. CAI encoding is in the CP/M operating system providing ease of using Chinese characters directly in various languages.

BCT-4 input device is a self-defined general purpose small keyboard and universal small keyboard, when acting as an on-line terminal, the host computer is a Chinese character transmission source. In addition to CAI coding, the input codes provided are telegraphic code, phonetic code and GB code. The BCT-4 character library includes all GB level one and level two characters and several hundred expansion characters for a total of 7,000 characters and symbols which are stored on floppy disk. The character library is divided into three levels. Level one library is about 1,000 characters which are stored internally and can be deleted, altered or added to by the user. The level two library is about 200 characters which are also stored internally, ordinarily this is empty and is used to store common characters which are called from floppy disk and can be automatically exchanged as needed. The level three library is an external library on floppy disk with a maximum capacity of 10,000 characters.

The BCT-4 Chinese character system's primary functions are:
1) using Chinese BASIC to write Chinese character processing programs to output Chinese characters; 2) calling Chinese character text editor program to set up or edit Chinese character files; 3) for specifying files on floppy disk for display or printing; 4) acting as terminal for accepting host computer Chinese character files; 5) automatic writing dot matrix characters; 6) internal storage maintenance; 7) external storage maintenance; 8) color graphics.

8226
CSO: 4008/1001

APPLIED SCIENCES

DBZ80-1 SINGLE-BOARD COMPUTER PASSES DESIGN EVALUATION

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 2, 23 Jan 84 p 6

[Article: "DBZ80-1 Single-board Computer Passes Design Evaluation"]

[Text] The Production Supply Bureau of the Ministry of Education recently organized in Shanghai a design evaluation meeting for the DBZ80-1 single-board computer. The new computer passed evaluation at the meeting.

This single-board computer was designed by the Qinghua University Department of Computers and test produced by the Huadong Normal University Science and Education Instrument Plant in Shanghai. Compared with single-board computers generally, this computer has some special features in terms of hardware and software design and configuration: it has powerful bus load ability, large storage capacity, complete peripheral interfaces, and abundant software. It not only has general purpose serial and parallel interfaces, but also has A/D and D/A conversion circuits; in addition to having a small and vigorous basic monitor, there is also a CRT monitor and BASIC language, and there are general system machine debugging and development techniques.

This computer is now in small batch production.

8226
CSO: 4008/1001

APPLIED SCIENCES

STATE-OF-THE-ART OF OPTICS IN CHINA REVIEWED

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 5, No 1, Jan 85 pp 1-10

[Article by Wang Daheng [3769 1129 3801], Director, Optics Society of China, and Wo Xinneng [3087 2450 5174] of the Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences: "Present State of Optics in China"]

[Text]

Abstract: The state-of-the-art of optics and applied optics in China is reviewed. Developments in lasers, infrared and opto-electronic techniques, optical metrology, high-speed photography, holography and information processing, nonlinear optics, optical fiber communications and optical techniques are described. Further development of optics and applied optics in China are proposed.

The optical industry in China was developed mostly after the Revolution. Research institutes were established shortly after the Revolution to engage in the study of optical techniques, materials and components. Typical optical instruments of the time were examined and test produced. With China's own effort and some foreign assistance, China established its early optical industrial system. Since the 1960's, optical research began to move toward the area of modern optics; lasers, infrared technology, and high-speed photography enjoyed rapid development and optical signal processing and fiber optics also began to evolve. Some of the major developments (up to 1979) were discussed in the article[1] "Developments of Optical Technologies in China." As the areas above continued to develop, more attention was directed to fundamental and theoretical research. Optical information theory, laser physics and laser spectroscopy, and nonlinear optics have moved forward and fiber optics communication has also begun to attract attention.

The Chinese Academy of Sciences has institutes in Changchun, Xian, Shanghai, Chengdu, and Anhui devoted to optical engineering, laser, infrared physics and technology, and high-speed photography. There are other institutes partially devoted to the research of fundamental optics and modern optics. Many major universities have departments or research laboratories engaged in the teaching, research and development of optical instruments, optical technique, and

fundamental optics, such as those at Zhejiang University, North China Industrial College, Qinghua University, Beijing University, Fudan University, Nankai University, Tianjin University, Zhongshan University, Changchun College of Optics and Fine Mechanics, Central China Engineering College and the Chinese University of Science and Technology. Some industrial ministries have also established research institutes and optical plants, mostly under the ministries of machine building, electronics and weapons. Many other departments and local governments also have their own small or medium scale specialty shops. On the whole, China has gained a certain level of capability in the scientific research, teaching, production and management of optical technology, but compared with advanced world standards, China still lags behind by a considerable distance. Much more efforts are needed to bring the optical technology of China to meet its needs of modernization.

The Optics Society of China was established in late 1979. To facilitate the academic activities in the Society, specialty committees on fundamental optics, engineering optics, laser electro-optics and infrared technology, optical material, high-speed photography and photons, thin film optics, spectroscopy (stressing applied spectroscopy), color optics and technological information were established. The Society publishes GUANGXUE XUEBAO [Acta Optics Sinica], ZHONGGUO JIGUANG [Chinese Journal of Lasers], HONGWAI YANJIU [Chinese Journal of Infrared Research], GUANGXUE GONGCHENG [Optical Engineering], and GUANGPU YU GUANGPU FENXI [Spectroscopy and Spectral Analysis]. In addition, the Society also publishes a popular science magazine called GUANG DE SHIJIE [The World of Light].

In the space below, we shall give an account of the scientific and technological advances of optics in China in recent years.

I. Lasers

China produced its first ruby laser only 1 year after the development of the first laser in the world.[2] An institute devoted to laser research was established as early as 1964. Research on powerful lasers and new types of lasers has always played an important role in laser research. The development and application of lasers have took hold in many Chinese institutes.

1. Powerful Lasers

In 1977 China began its construction of a 1×10^{11} W, 0.1 ns, six-beam neodymium glass laser system for the study of laser plasma. The system underwent several revisions and improvements and a target chamber and the associated laser plasma diagnostic equipment were added. The focusing of the laser at the target surface and the synchronization of the beams were improved.[3] The power density at the target surface has reached 10^{14} W/cm^2 and the test runs produced good results.[4] The compression of hollow glass microsphere targets was achieved with the focused laser. The temporal and spatial structural characteristics of the 2ω spectrum were obtained using a planar aluminum target. The population inversion of the $n = 3$ and $n = 4$ energy levels of Mg^{+10} ion (with a transition wavelength of 154.8 Å) was observed. (An inversion layer was found to exist not only far away from the target surface but a new inversion layer with a higher electronic density was also found in the vicinity of the target surface.)

In this period, efforts were made to study the technologies of high power neodymium lasers, including the stability improvement of the output pulse, suppression of the precursor noise of the laser pulse, improvement of the wavefront smoothness by spatial filtering, and the optimization of the neodymium glass composition and optical properties and the design of the system.

2. High Power CO_2 Lasers and Heat Treatment

China has developed 1000 W and 5000 W lateral flow closed cycle CO_2 lasers[6] and is in the process of setting up the necessary heat treatment equipment for various applications. Lasers are used for cutting in the production process. Lasers have also been used in the heat treatment of steel surfaces to increase the hardness and the wear resistance and such applications have been demonstrated experimentally and put into practical use.

3. Laser Range Finding

A satellite range finder using a Nd YAG frequency doubling laser has been used in the measurement of the orbit of the LAGEOS satellite. The range is 6000-7000 km and the accuracy is 20-30 cm. (The telescope aperture is 625 mm, the laser pulse width is 45 ns, the output energy is 300 mJ and the repetition rate is 0.5 Hz)[7].

Miniaturized laser range finders[8] using NdP_5O_{14} as a medium weigh only 23 grams, use an argon lamp as the pump, the pulse width of the Q-switched dye laser is less than 10 ns, the peak power is in the MW range, the distance range is 60-3000 m, and the accuracy is 2.5 m.

4. Laser Gyro

China developed a four-frequency differential motion ring laser gyro[9] equipped with a Faraday chamber and a quartz polarizer differential plate in the resonance cavity. The zero drift is 0.07-0.11°/hr, the angular range is 360°, and the repeatability[10] is better than 0.3".

5. Various Lasers

Isomer lasers: China has developed discharge pumped or electron beam excitation pumped XeF, XeCl, XeBr, KrF, KrCl, ArF and Xe_2^* isomer lasers (center wavelengths respectively 3511, 3080, 2820, 2485, 2230, 1930, and 1730 A) and has also investigated three atom isomer lasers.[11]

Ring lasers[12]: China has developed single mode continuous wave tunable ring dye lasers with a line width less than 50 MHz and a power greater than 400 MW. The picosecond ring-shaped dye laser has a passive mode locked pulse width less than 0.5 ps, an active mode locked pulse width of 10 ps and an average power greater than 50 MW.

Solid state lasers: In addition to the silicate neodymium glass lasers, China also developed phosphate neodymium glass lasers.[13] The technique and

production rate for growing the laser crystals and frequency doubling crystals have been improved.[14,15] A variety of rare earth doped oxide and fluoride crystals and high concentration activated crystals[16,17] have been produced. Work on color center crystals are underway.[18,19]

Gas lasers: New areas of investigation include high power copper vapor lasers[20] and gold vapor lasers.

6. International Laser Conference

The 1983 International Laser Conference was held in Guangzhou, China, in September 1983. Chinese researchers delivered 155 oral and poster papers, including 37 papers co-authored by Chinese and foreign scientists and 3 papers were submitted by authors in Hong Kong and Macao.

II. Infrared and Photoelectrical Technology

1. Infrared Detectors

Infrared components developed earlier include vacuum temperature difference thermocouples, semiconducting heat sensitive resistors, and PbS, PbSe, InSb, Ge:Hg photoelectric sensors, some of them have already been used in arrays. Recently efforts have been made to study HgCdTe in the 1-30 μm range as specific wavelength response sensors. The D^* value of PbTe/PbSnTe heterojunction has reached 2.91×10^{10} cmHz$^{1/2}$W^{-1} and a ten-element linear array[22] of such junctions has a $D^*_{10\ \mu m}$ of 1.94×10^{10} cmHz$^{1/2}$/W. Polarization locking thermoelectric elements of TGS, $LiTaO_3$, PZT, and PVF_2 LATGS sensors have a D^* of $1 \sim 2 \times 10^9$ cmHz$^{1/2}$/W. Television camera tubes made of TGS crystal has a spatial resolution of 220 TVL/raster at a temperature difference of 0.5°C. Some of these sensors have been made into arrays in applications. The corresponding microrefrigeration technology has also been developed, including the radiation refrigeration technique for space use.

2. Applications of the Infrared Technology

The infrared technology has found extensive applications in remote sensing, medical thermo-imaging, tracking and guidance, satellite attitude control, industrial temperature measurement and moisture detection. Examples include multispectral scanning camera in remote sensing, temperature sensing of locomotive axles, thermo-imaging in medical diagnosis and industrial flaw detection, and the monitoring of forest fires.

3. Photoelectric Vacuum Components

China had earlier developed infrared image converter tubes and image enhancement tubes and is still working on the improvements. New efforts are directed to the use of fiber optics plate and microchannel plate for the development of the next generation image enhancement components for weak signals.

In the area of television camera tubes, China has made an effort to develop lead oxide camera tubes and achieved the quality of industrial television. Special television pick-up tubes include infrared sensitive lead oxide-lead sulfide vidicon, secondary conduction camera tube, silicon target camera tube, and silicon target storage tube. In addition, CCD solid state camera components are being developed and 1024 element units are in test use. Also developed are[24] 100x108, 120x150, 200x300, 256x320, and 320x512 arrays.

III. Optical Measurements

1. Luminous Power Equivalence K_m and the Reproducibility of the New Light Intensity Unit[25]

(1) Before the announcement of the new light intensity unit cadella in 1979, China had been using the absolute radiometer and established the platinum condensation point for the light intensity standard and for K_m measurement. The measured K_m was 684 Lm/W with an uncertainty of $\pm$ 0.3 percent.

(2) In the new definition of the light intensity, the uncertainty of the electrically calibrated 2856 K radiation is 0.4 percent. Compared to the British NPL and the West German PTB, the Chinese value is 0.2-0.3 percent lower; compared to the old Chinese standard, the new value is 0.1 percent lower.

(3) The vision function V(x) is commonly used in the practical photometric measurements but some discrepancies were recently found between the short wavelength data and new experiments. Notably the vision function data do not include data of the Asians. China has recently measured the average data of several dozen observers using a color matching method and the results are in basic agreement with the new foreign results, indicating that the visual characteristics of the Chinese do not differ significantly from those of other races.

2. Redefining the Meter Using Stable Lasers[26-28]

(1) China has independently produced methane saturation absorption stable frequency He-Ne lasers (λ = 3.39 μm) and iodine stable frequency He-Ne lasers (λ = 633 nm).[29] Compared to BIPM traceable lasers, the former has a frequency discrepancy of 2×10^{-11} and the latter has 3×10^{-11}. The intrinsic discrepancy of 1×10^{-11}. We have made stable frequency lasers and have therefore met the international standard for reproducibility.

(2) Researchers at the Chinese Institute of Measurement have contributed to the development of the iodine stabilized He-Ne laser wavelength at λ = 612 nm called for in the current definition of the meter.

(3) Recently an iodine stabilized He-Ne laser with a wavelength of 640 nm has been developed as a stable frequency standard.

3. Measurement of Absolute Acceleration Due to Gravity[30]

The absolute gravitometer for free-falling bodies developed in China makes use of laser interference in the measurement of the acceleration due to gravity. The Chinese measured a value of g = 980925914 ± 15 μg and Mr (Zuojiujian) of the International Bureau of Measurement in Paris measured a g = 980925908 ± 8 μg. The agreement is within the error bar.

IV. High-speed Photography[31]

The following is an account of the development of the high speed photography in China:

1. 35 mm intermittent high-speed camera: capable of 240-300 f/sec.

2. Rotating prism compensating camera: capable of 2000 f/sec using 35 mm film and 8000-10,000 f/sec using 16 mm film.

3. Rotating mirror high-speed camera: rotational speed of mirror is 5×10^5 rpm, photography speed is 2×10^7 f/sec in frame shots and the scanning speed is 27 mm/μs using a beryllium alloy mirror.

4. Slit-type high-speed camera: Uses 70 mm film, dynamic resolution greater than 28 line-pairs per mm, film speed 0.6-75 mm/sec and adjustable.

5. Image converter camera: China has developed a waiting-time frame-by-frame image converter camera with a minimum exposure time of 20 ns. The temporal resolution of the converter scanning camera was estimated experimentally to be 3 ps.

6. High-speed X-ray camera: time resolution has reached the ns order.

7. Reticle high-speed camera: China has developed cylindrically orthogonal organic glass reticles with a pitch of 0.3 mm and with 9×10^9 picture element. Combined with the image converter camera, the expected temporal resolution should be of the ps order.

8. Laser holographic high-speed camera: using a ruby laser, the holographic camera is capable of double exposure holographic photography and high-speed dynamic interference imaging. The half width of the light pulse is less than 50 ns and the time interval is 4×10^4 f/sec.

V. Holographic Photography and Optical Signal Processing

Holographic photography has been widely developed and applied in China. Examples include holographic photoelasticity, holographic nondestructive flaw detection, holographic high-speed photography, wind tunnel flow field and laser wavelength characterization, and holographic interferometry. Domestically produced holographic gratings have been used in optical spectrometers. Computed holography has been successfully used in the inspection of spherical surface and in the fabrication of holographic optical elements. Holographic

lens arrays are used in multiple matched filters and multichannel signal processing. Good progress has also been made in holographic image reconstruction techniques. Holographic storage and reproduction may now be used in document storage and copying.[32]

Suitably expanded light sources and light path arrangement may be used to suppress coherent noise in holography. This method has been used to improve the image quality of holographic micrographs and multicolor holograms.[33-35]

In the area of optical signal processing, many units are conducting research in the processing of coherent light, multicolor light and white light. Computed holography has been proposed for achieving general unitary transformation and thereby performing various linear transformations with optical method. Other areas of study include image subtraction, Chinese character recognition, Doppler radar signal processing, processing of large motion blurred images, image quality improvement with holographic filter, coded aperture imaging, pseudocolor coding, optical processing of side-viewing radar signals, elimination of spectral background noise, and deconvolution operation. Most of the efforts are extensions of existing technology and remain in the laboratory verification stage, but some have already been applied with good results.

White light processing has receive more attention in China because it helps to suppress coherent noise and is compatible with colored signal processing; in addition, it does not require a laser or a vibration-free table. A number of studies corresponding to similar work in coherent light have been made. It is now clear that most of the operations for the coherent light can be achieved with white light. In the area of target coding, the conventional grating coding was improved and several speckle coding methods have been developed with good success. Considerable work was done for pseudocolor coding and frequency spectrum coding while making use of the advantages of white light. Some of the studies have led to unique advantages in their applications. Coding and decoding techniques in white light processing have made it possible to take color photographs with silver salt black and white films and to reconstruct color images with the white light processor. In addition, light source coding has also been studied with an eye toward upgrading the light source utilization rate in white light processing and improving the signal-to-noise ratio.

Significant results[36-47] have been obtained for some fundamental problems in signal processing such as the degrees of freedom of the image, the data volume and the phase reconstruction technique.

VI. Nonlinear Optics

Frequency doubling and parametric oscillation have effectively extended the bandwidth of lasers, Stimulated Raman scattering of hydrogen under high pressure has also helped to extend the bandwidth in some laboratories.[48-53]

Stimulated Raman scattering and its intensity distribution in long fiber optics have been studied. Tenth order stimulated scattering has been achieved[54-57] and the results hold promise for a broadband laser source. Crystalline structure and vibration modes have also been studied with Raman scattering.

Both the mechanism and the applications of four wave mixing have been investigated. Using a delay method, the nonlinear refractive index and the relaxation mechanism of dyes and liquid crystals have been studied. Also proposed[58-63] are up conversion by four wave mixing, correction of wavefront error by four wave mixing, and investigation of phase change in liquid crystals and anisotropy of dye molecules with four wave mixing. Systematic studies have also been made on the theory of transient four wave mixing.[64,65] The study of surface nonlinear optics is just beginning in China but results have been obtained in the generation of infrared surface second harmonics.[66]

China is currently using a hybrid system in the study of the bistable state and has made the first observation of optical bistability in liquid crystals.[67] Bistability and multiple stability have been studied with several different interferometers.[68-73]. A theory of optical hybrid bistable system is established[74] and the self-pulse caused by dual feedback has been studied. Experimental verification[75-78] of the periodic oscillation, branching and chaos of the optical bistability has been made.

The switching of the optical frequency Kerr effect caused by ultrashort pulse and semiconducting photorectification has been studied.

VII. Fiber Optics Communications[79,80]

China has succeeded in making quartz fiber optics with an attenuation of 0.5 dB/km, approaching the theoretical limit. Fiber optics with a loss less than 3 dB/km are in production, the bandwidth is generally 200-800 MHz/km and the acceptance rate is 80 percent. China has installed more than 10 fiber optics circuits between telephone companies in Beijing, Shanghai, Wuhan, and Guilin, with a total length of 100 km. The first fiber optics communications system with a total length of 13.3 km has been installed and is operating at a wavelength of 1.3 μm and at 34 Mbit/sec.

The service life of semiconductor laser sources, an important component of the fiber optics communications system, has reached 10^4 hours or longer and China can now supply 1.3-1.5 μm semiconductor lasers and 1.0-1.6 μm PIN detectors.

VIII. Optical Technology

1. Optical Design[81]

The major developments are:
(1) Computer optimization of optical systems has been more widely used.

(2) In the vision system the human eye is considered one component of an optical system and the aberration correction is included in the overall consideration.

(3) Common glass (instead of special dispersion glass) is used in the chromatic aberration. A practical design has been made: (f/7, field of view angle 18°, second order spectrum = 0, F chromatic spherical aberration = 0.13 percent f, astigmatism = 0.1 percent f.)

(4) Designed and produced the following typical objective lenses: 1) NA = 0.65 flat image field apochromatic microscope objective. 2) Large field of view, high resolution, precision reducing lens, effective imaging range ϕ 8, f/1.4, 0.1x, spectral e, conjugate distance 315 mm, resolution about 500 line-pairs per mm. 3) Photographic mask objectives (focal length 180-1200 mm, f/9, f/11 at maximum focal length, -1x breadth, corresponding to 300-1800 mm). 4) Variable focal length objectives used in color television photography and 35 mm and 16 mm movies. For example, objectives with 20x, 25-500 mm focal length and f/4 in 33 mm movie photography. 5) Wide angle aerophotographic objectives, f/4, field of view angle 122°

2. Thin Film Optics[82]

Recent developments include:
(1) Computer optimization of thin film systems.

(2) Electron guns or CO_2 lasers are used in the evaporation of thin films to produce a multiple layer hard film.

(3) Better control of film thickness and fabrication of films with arbitrary thickness.

(4) Formation of broadband antireflecting film using films of gradually varying index of refraction.

(5) Control of the oxidation of the film with evaporation in an oxygen atmosphere.

(6) Established a 3 m diameter large vacuum coating facility.

(7) Developed a chemical titration centrifuge coating method for large diameter optical components.

(8) Developed high efficiency resistive films with surface properties improved by ion exchange method.

(9) Special films, such as high transmissivity films for laser applications, high reflectivity and radiation resistive films, bandpass films such as filters for color television, narrow band filters, soft X-ray filters, infrared filter films, function films such as gradually varying wavelength filters.

3. Optical Materials

(1) General purpose optical glasses, domestic production is self-sufficient.

(2) Optical glass by continuous melting. In production stage, with imported technology.

(3) Domestically produced neodymium silicate and phosphate glasses for high power lasers.

(4) Optically uniform phosphor fluoride glass, used in apochromatic optical systems.

(5) Infrared transmissible materials: Infrared transmissible glasses, including infrared cutoff filter glass, germanate glass, hot-pressed polycrystalline materials such as MgF_2, ZnS, ZnSe, and CaF_2; man-made crystals such as NaCl, CaF_2, KBr, BaF_2, and KRS_5.

(6) Laser crystal: Ruby, Nd:YAG, Nd:YLF, and other rare earth doped (mainly Nd) and high concentration self-activated crystals.

(7) Laser frequency doubler and nonlinear optical materials: KDP, KD*P, $LiNbO_3$, and other electro-optic, acousto-optic, and magneto-optic materials used in signal processing.

(8) China has test production of fiber optics with a gradient of refractive index for communication use. Multimode fiber optics are already in use in optical communication. In addition, imaging optical fibers for image transmission, fiber optics plates, and microchannel fiber optics plates are also under development.

(9) Glass with a zero thermal expansion coefficient has been developed and used in the fabrication of the main mirror of the astronomical telescope.

4. Optical Technology[84]

Milestones in this area are:
(1) Designed and built a precision optical transfer function measurement system with a maximum error less than 5 percent.

(2) The 2.16 m main mirror of the astronomical telescope has been finished.

(3) China has built a diffraction grating engraver controlled by Moire interference fringes. It can engrave 1200 lines/mm and 600 lines/mm over a 150x120 mm^2 area. The engraved gratings and the replicas have been used in Chinese spectrometers and the solar spectrometers in the observatory.

(4) Axial angle encoders have achieved an accuracy of 1" and the circular dial graduation accuracy is less than $\pm$ 0.1" in terms of the diameter error.

(5) An interference method is used to measure the graduation of a high-accuracy scale to an accuracy of 0.05 μm.

5. Optical Instruments

China produces most of the conventional optical instruments such as microscopes, survey instruments, precision measurement instruments, cameras, television cameras, movie projectors, aerophotographic instruments, spectrometers, and military optical instruments. However, some lines of product are incomplete and high quality products, especially products using electronic technology and microprocessors, are generally lacking. We now

describe some typical instruments as a reference of the product standard but the readers should bear in mind that these are isolated products not yet put into mass production.

(1) Remote sensing equipments:[85] multispectra camera, multispectral scanner, pseudocolor synthesizer for remote sensing picture interpretation and image density divider, and ground object spectral radiometer for research use.

(2) Astronomical instruments:[86] The 1.5 m diameter main mirror of the equatorial telescope has reached the installation stage, the 2.16 m main mirror of the astronomical telescope is approaching completion. China has also developed an astrolabe with automatic compensation for the astronomical refraction. A Schmidt camera for the observation of artificial satellite orbit has also been developed.

(3) Optical tracking and survey instruments:[87] Several models were developed including a high performance tracking movie theodolite with the main telescope aperture in the ϕ100 mm to ϕ500 mm range, equipped with infrared automatic tracking, television tracking and laser range finding, and capable of real time measurement of the target miss. The angular precision is generally better than 12". In addition, projectile trajectory camera and laser satellite range finder have also been developed.

(4) Spectrometers: High-quality spectrometers include the atomic absorption spectrophotometer, vacuum ultraviolet quantometer Raman spectrometer, grating double monochronometer, and tunable ring lasers.

(5) Optical instruments for LSI technology: Under development.

IX. Conclusions

Based on the discussion above, we believe the following are important issues for future development.

(1) In the area of the development of the optical science and technology on its own right and on its relationship to other modern science and technology, China has made some contribution to the basic research and theoretical research. However, more efforts are needed to improve the actual results in this area.

(2) In the area of the development of optical equipments, more attention should be paid to the integration of light, mechanics, electricity and computer to meet the needs of modern science and technology. Also warrant more attention are the reliability of the instruments and improvements of the instrument structure to satisfy the new needs of the users. New optical principles and equipments should be developed following the direction of modern science.

(3) From an organizational approach, the integration of scientific research, production and application should be strengthened, the management efficiency should be improved and a collaboration system should be established for more efficient research, better product quality and higher efficiency.

(4) To meet the challenges of modern science and technology, the knowledge and technical level of the entire optics profession must be improved.

Acknowledgements: The authors thank Deng Ximing [6772 6932 6900], Mu Guoguang [3018 0948 0342], Chen Xingdan [7115 2502 2481], Zhang Hongjun [1728 3163 6874], Yu Wenyan [0151 2429 3508], Chen Yingli [7115 5391 4409], Wang Jiaji [3769 0163 1015], Chen Liangyi [7115 5328 0001], and Yu Futang [0205 4395 1016] for their comments.

This is an invited paper presented at the ICO-XIII Post Congress Meeting held at Tsubuka, Japan, on 27 August 1984. (Received 21 July 1984, revised 30 Oct 1984).

REFERENCES

1. Wang Daheng [3769 1129 3801], GUANGXUE XUEBAO [Acta Optica Sinica], Vol 1, No 1, p 1, Jan 1981.

2. Wang Zhijiang [3769 0037 3068], et al., ZIRAN KEXUE NIANJIAN Natural Science Annual, No 1, p 29, 1979.

3. Deng Ximing [6772 6932 6900], et al., ZIRAN KEXUE NIANJIAN, No 1, p 76, 1982.

4. Deng Ximing, et al., GUANGXUE XUEBAO, Vol 1, No 4, p 289, July 1981.

5. KEXUE TONGBAO [Science Bulletin] (Special edition on mathematics, physics, and chemistry), p 155, Nov 1980, Yu Wenyan [0151 2429 3508] et al., ZHONGGUO KEXUE [Chinese Science], No 11, p 1047, Nov 1982(A). Lu Renxiang [4151 0088 4382], et al., ZHONGGUO KEXUE, No 6, p 537, June 1984(A). Tan Weihan [6223 4850 5060], et al., ZHONGGUO KEXUE, to be published.

6. Wang Zheen [3769 0772 1869], et al., 1983 ICL Digest, edited by the editorial board of AOS, p 216, 1983.
Li Zaiguang [2621 0375 0342] et al., ibid.

7. Chen Qinghao [7115 1987 3185], et al., ZHONGGUO JIGUANG [Chinese Journal of Lasers] Vol 10, No 6, p 382, June 1983.

8. JIGUANG [LASER], Vol 9, No 10, p 684, Oct 1982.

9. Xu Yi [1776 3015], et al., JILIANG XUEBAO [Journal of Measurement], Vol 2, No 3, p 163, May 1981.

10. JIGUANG, Vol 8, No 7, p 3, July 1981.

11. Proceedings of the 6th National Conference on Lasers, Anhui, China, p 34, 1982.
Guo Zhenhua [6753 2182 5478], et al., ZHONGGUO JIGUANG, Vol 10, No 10, p 685, Oct 1983.

12. Private Communication.

13. Qi Changhong [4359 7022 3414], et al., JIGUANG, Vol 8, No 11, p 691, Nov 1982.

14. Chen Chuangtian [7115 0482 1131], et al., 1983 ICL Digest, edited by the editorial board of AOS, p 359, 1983.

15. Tan Zhongke [6223 1813 1870], et al., ibid, p 361.

16. Bai Yunqi [4101 0061 6386], et al., JIGUANG, Vol 9, No 6, p 409, June 1982.

17. Wang Qingyuan [3769 1987 0337], et al., ZHONGGUO JIGUANG, Vol 10, No 10, p 730, Oct 1983.

18. Sun Rongfu [1327 2837 0265], et al., ZHONGGUO JIGUANG, Vol 10, No 11, p 778, Nov 1983.

19. Zhang Guifen [1728 6311 5358], JIGUANG, Vol 9, No 5, p 332, May 1982.

20. Liang Baogen [2733 1405 2704], et al., JIGUANG, Vol 8, No 1, p 18, Jan 1981.

21. I Min [0044 3046], GUANGXUE XUEBAO, Vol 3, No 9, p 827, Dec 1983.

22. Zhang Suying [1728 4790 5391], et al., HONGWAI YANJIU [Chinese Journal of Infrared Research], Vol 3, No 3, p 180, Sep 1984.

23. He Shumei [0149 0647 1520], et al., HONGWAI YANJIU, to be published.

24-25 Private Communications

26. Shen Naicheng [3088 0035 3413], et al., JILIANG XUEBAO, Vol 2, No 2, p 140, Mar 1981.

27. Comite Consultatif pour la Definition du Metre, 7e Session (3-4, Juni 1982);
Com. Int. Poids Mes., CCDM 7e Session, 1982. Recomin, M1 and M2.

28. Zhao Kegong [6392 0344 0501], et al., GUANGXUE XUEBAO, Vol 3, No 8, p 673, Nov 1983.

29. Li Fu [2621 1788], et al., ZHONGGUO JIGUANG, Vol 10, No 2, p 85, Feb 1983.

30. Wo Xinneng [3087 2450 5174], ZIRAN KEXUE NIANJIAN, No 2, p 140, 1981.

31-32 Private Communications

33. Yang Guoguang [5017 0948 0342], et al., GUANGXUE XUEBAO, Vol 4, No 5, p 419, May 1984.

34. S. L. Zhuang, (Coherence requirement, transfer function and noise performance of partially coherent processing system), (Ph. D. Thesis, Penn. State University, 1983, Univer. Microfilm, Ann Arbor, Mich.)

35. Yang Guoguang, et al., GUANGXUE XUEBAO, Vol 4, No 12, p 1115, Dec 1984; ibid, Vol 5, No 1, p 38, Jan 1985.

36. F.T.S. Yu, Zhuang Songlin [8369 2646 2651], et al., GUANGXUE XUEBAO, Vol 1, No 1, p 13, Jan 1981.

37. F.T.S. Yu, Mu Guoguang, et al., WULI XUEBAO [Acta Physica Sinica], Vol 30, No 6, p 841, June 1981.

38. Mu Guoguang, et al., GUANGXUE XUEBAO, Vol 1, No 6, p 493, Nov 1981. Mu Guoguang, et al., WULI XUEBAO, Vol 31, No 11, p 1547, Nov 1982.

39. Huang Degen [7806 1795 2704], et al., Vol 4, No 2, p 139, Feb 1984.

40. Mu Guoguang, et al., GUANGXUE XUEBAO, Vol 4, No 8, p 687, Aug 1984.

41. Mu Guoguang, et al., YIQI YIBIAO XUEBAO [Journal of Instruments and Meters], Vol 4, No 2, p 124, May 1983.

42. Mu Guoguang, et al., ZHONGGUO JIGUANG, Vol 10, No 8-9, p 647, Sep 1983.

43. Chen Zhenpei [7115 4394 1014], et al., GUANGXUE XUEBAO, Vol 2, No 2, p 134, Mar 1982.

44. He Mingxia [6320 2494 7209], et al., GUANGXUE XUEBAO, Vol 3, No 4, p 303, July 1983.

45. Kang Hui [1660 6540], et al., GUANGXUE XUEBAO, Vol 3, No 4, p 298, July 1983.

46. Guo Lurong [6753 1462 1369], et al., GUANGXUE XUEBAO, Vol 4, No 2, p 145, Feb 1984.

47. Yang Zhenhuan [2799 2182 1403], et al., GUANGXUE XUEBAO, Vol 5, No 2, p 107, Feb 1985.

48. Liu Simin [0491 1835 2404], et al., WULI XUEBAO, Vol 32, No 5, p 657, May 1983.

49. Yang Tianlong [2799 1311 7893], GUANGXUE XUEBAO, Vol 3, No 8, p 702, Nov 1983.

50. Liu Simin, et al., WULI XUEBAO, Vol 32, No 1, p 103, Jan 1983.

51. Liu Simin, et al., ibid, Vol 33, No 1, p 105, Jan 1984.

52. Liang Peihui [2733 1014 6540], et al., GUANGXUE XUEBAO, Vol 3, No 4, p 289, July 1983.

53. Liu Songhao [0491 7313 6275], et al., WULI XUEBAO, Vol 31, No 3, p 328, Mar 1982.

54. Gao Peijuan [7559 0160 1227], et al., JIGUANG, Vol 7, No 4, p 11, Apr 1984.

55. Yang Tianlong, et al., ZHONGGUO KEXUE, No 3, p 281, Mar 1984(A).

56. Yang Tianlong, et al., WULI XUEBAO, Vol 30, No 2, p 199, Feb 1981.

57. Yang Tianlong, et al., GUANGXUE XUEBAO, Vol 3, No 9, p 850, Dec 1983.

58. Chu Guiyin [0443 2710 5593], et al., WUILI XUEBAO, Vol 28, No 6, p 887, Nov 1979.

59. Wu Cunkai [0702 1317 1956], et al., WULI XUEBAO, Vol 30, No 2, p 189, Feb 1981.

60. Wu Cunkai, et al., GUANGXUE XUEBAO, Vol 4, No 2, p 112, Feb 1984.

61. Ye Peixian [0673 0160 1720], et al., ZHONGGUO KEXUE, No 2, p 179, Feb 1981(A).

62. Zhu Huanan [2612 0553 0589], et al., WULI XUEBAO, Vol 33, No 4, p 564, 568, Apr 1984.

63. Chu Guiyin, et al., WULI XUEBAO, to be published in 1985. (Article presented at the 13th International Conference on Quantum Electronics)

64. Ye Peixian, et al., Phys. Rev. A25, 2183(1982).

65. Ye Peixian, et al., WULI XUEBAO, to be published.

66. Chen Zhenghao [7115 2973 6275], et al., Opt. Lett. 8, 563(1983).

67. Zhang Hongjun [1728 3163 6874], et al., WULI XUEBAO, Vol 30, No 6, p 810, June 1981; Opt. Commun. 38, 21 (1981).

68. Li Chunfei [2621 3196 7378], et al., HARBIN GONGYE DAXUE XUEBAO [Journal of the Harbin Industry University], No 1, p 1, 1982.

69. Li Yushan [2621 3768 0810], et al., GUANGXUE XUEBAO, Vol 3, No 8, p 685, Nov 1983.

70. Li Chunfei, et al., HARBIN GONGYE DAXUE XUEBAO, No 1, p 9, 1982.

71. Dai Jianhau [2071 1696 5478], et al., GUANGXUE XUEBAO, Vol 3, No 1, p 46, Jan 1983.

72. Li Yonggui [2621 3075 6311], et al., WULI XUEBAO, Vol 31, No 4, p 446, Apr 1982.

73. Li Chunfei, et al., GUANGXUE XUEBAO, Vol 3, No 9, p 811, Dec 1983.

74. Li Yonggui, et al., WULI XUEBAO, Vol 32, No 3, p 301, Mar 1983.

75. Li Yonggui, et al., WULI XUEBAO, Vol 32, No 3, p 309, Mar 1983.

76. Zhang Hongjun, et al., Laser Spectroscopy VII, Springer Ser., Vol 40, p 322, 1984.

77. Zhang Hongjun, et al., WULI XUEBAO, Vol 33, No 7, p 1024, July 1984.

78. Li Chunfei, et al., GUANGXUE XUEBAO, Vol 4, No 10, p 907, Oct 1984.

79. Private communication.

80. I Min, GUANGXUE XUEBAO, Vol 1, No 4, p 322, July 1981.

81-87 Private communications.

9698
CSO: 4008/306

SINGLE MODE PHASE LOCKING FIBEROPTIC SENSOR DEVELOPED

Shanghai YINGYONG JIGUANG [APPLIED LASER] in Chinese Vol 5, No 1, Feb 85 pp 43-44

[Article by Wang Jinghua [3769 2529 5478], Xie Haiming [6200 3189 2492], and Cui Jianhua [1508 1696 5478] of the Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences and Li Dazhong [2621 1129 0022] of the Shanghai Institute of Silicate, Chinese Academy of Sciences: "A Single Mode Phase Locking Fiberoptic Sensor"]

[Text] Abstract: This paper reports a single mode phase locking strain sensor. With this sensor, earth shell deformation and solid tide could be detected. This sensor has greatly improved the measurement sensitivity.

I. Introduction

As the theory and manufacture technology of fiberoptics improve, noncommunication applications of fiberoptics, mainly the fiberoptic sensors, have moved from research to practice.

In contrast to conventional methods, the fiberoptic sensors have the following advantages: electrically nonconducting, immune to electromagnetic interference, corrosion resistent, light weight and compact, safety in explosion, combined transmission and reception, low disturbance to the medium under sensing, high sensitivity and compatibility with intelligent measurement and systems. In the 7 short years since its invention, more than 60 fiberoptic sensors have been developed and found extensive applications in optics, electromagnetics and mechanics.

II. Principles and Analysis

We report the development of a single mode phase locking fiberoptic strain sensor with potential applications in the detection of earth shell deformation and solid tide. The principle of the device is illustrated in Figure 1.

The light beam from a stable frequency He-Ne laser is first collimated with lens L_1 and forms a reflected beam I_1 and a transmitted beam I_2 at the beam splitter BS_1. Beam I_1 enters the fiberoptic loop through lens L_2 and then

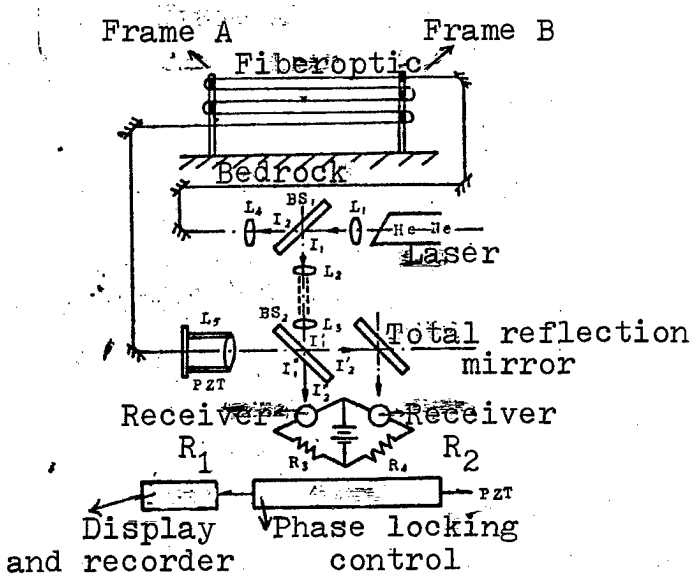


Figure 1. Principle of the fiberoptic strain sensor

goes through lens L_3 and forms a reflected beam I_1' and a transmitted beam I_1''. Beam I_2 enters the measurement fiberoptic after passing through lens L_4 and then goes through lens L_5 and forms a transmitted beam I_2' and a reflected beam I_2''. The extended length of the fiberoptic loop is equal to the length of the measuring fiberoptic so that the optical paths of I_1 and I_2 are equal. Since I_1' is reflected twice at the air-to-glass interface, it suffers a phase addition of 2π. I_2 is twice transmitted through an air-glass interface and suffers no phase change. I_1'' gain a phase difference of π since it is reflected only once at the air-glass interface. I_2 suffers no phase change as it is reflected once at a glass-air interface. Therefore, the phase of the interference pattern formed by I_1' and I_2' is different from that formed by I_1'' and I_2'' by π. The photosensors R_1 and R_2 form the two arms of the bridge circuit. The output signal of the bridge goes through a phase locked feedback control and controls the piezoelectric PZT element. The signal is also monitored and recorded. The measuring fiberoptic is wrapped around two posts installed on the bedrock, stretched to a slight tension, and then held in place with adhesive. By adjusting the PZT element, the interference signals from I_1' and I_2' and from I_1'' and I_2'' are made equal, the bridge is now balanced and the sensor is ready for operation.

As the bedrock deforms fiberoptic on the frame is elastically deformed and the phase of $I_1'I_2'$ and $I_1''I_2''$ changes in opposite directions. This causes an unbalance of the bridge incuit and the output error signal is fedback to control the PZT, which in turn adjusts the optical path in the reference fiberoptic loop to equal the optical path in the measurement fiberoptic. The error signal is displayed and recorded as an indication of the earth shell deformation.

Our optical path is actually a fiberoptic Mach-Zehuder interferometer. The signal mode fiberoptic is used as a strain sensing element. When the sensing

arm is stressed, the optical path in the sensing arm is also changed due to changes in the transmission characteristics and in the length of the fiber-optic.

Let the length of the measuring fiberoptic be L and the propagating constant be β, then,

$$\Delta\phi = \beta \cdot \Delta L + L \cdot \Delta\beta$$
$$= \beta \cdot L\left(\frac{\Delta L}{L}\right) + L\frac{d\beta}{dn} \cdot \Delta n + L\frac{d\beta}{dD} \cdot \Delta D$$

The phase shift caused by diameter change Δ D of the fiberoptic is two to three orders of magnitudes smaller than the phase shift of the first two terms associated with Δ L and Δ n. The Δ D effect can therefore be ignored. Since

$$\frac{d\beta}{dn} \approx R_0 = \frac{w}{C} \cdot n,$$

and

$$\Delta n = \frac{n^2}{2}[(P_{11} + P_{12})\delta_1 + P_{12} \cdot \delta_3]$$

where δ_1 and δ_3 are the transverse and longitudinal strain of the fiber-optic, P_{11} and P_{12} are the Pockels coefficients of the fiberoptic, calculation shows that the length change contribution to the phase shift $\Delta\phi$ is about 10 times greater than the contribution due to the refractive index change.

III. Experimental Results

If the two posts in Figure 1 are separated by a distance of 1 meter and the fiberoptic is wrapped n times, then a deformation Δ L of the bedrock will cause a length change n·Δ L in the fiberoptic. In other words, the bedrock deformation is "amplified" n times and the sensitivity of the sensor is increased n times. This makes the fiberoptic sensor very desirable.

In the experiment we simulated the earth shell deformation. A piezoelectric micrometer with a resolution of 40 Å/V is mounted on frame A. The micrometer is mounted on the same base plate as frame B. By manually adjusting the piezoelectric micrometer, the distance between frames A and B is changed. When the piezoelectric micrometer was adjusted to 300 V, the interferometer counted six interference fringes. Since we had three layers of fiberoptic on the frame, the total deformation in the fiberoptic is 3.6 μ m, which is equal to the total displacement of the interference fringes. (As an approximation, we take λ to be 0.6 μ m).

Laser interference systems using the phase locking technique have reached a resolution of 10^{-9}m. On that basis, the fiberoptic sensor may increase the sensitivity by another several times, in fact, one to two orders of magnitude.

The fiberoptic sensor developed in our laboratories may be operated in the harsh environment of a mountain cave. The compatibility of the sensor signal with data transmission and processing methods is another great advantage of the fiberoptic sensor.

The single mode, phase locking fiberoptic strain sensor is expected to have applications in geophysics, in nuclear explosion monitor, and in the deformation monitor of dams and bridges.

References

1. T. G. Giallorenzi et al., IEEE, J. Quan. Electron, QE-18, 626(1982).

2. P. G. Cielo, Appl. Opt., 18, 2933(1979).

3. N. Lagakos et al., IEEE., J. Quan. Electron, QE-18, 683(1982).

4. Charles M. Davis et al., "The Fiberoptic Sensor Technology Handbook," 1982.

9698
CSO: 4008/283

PRACTICAL OPTICAL MULTICHANNEL ANALYZER DEVELOPED

Shanghai YINGYONG JIGUANG [APPLIED LASER] in Chinese Vol 5, No 1, Feb 85 pp 45-48

[Article by Chen Jian [7115 0256], Li Weiliang [2621 0251 5328], Wan Wanlun [3769 8001 0243], Lin Weizhu [2651 0143 3796] and Li Wenchong [2621 2429 0394] of the Laboratory of Laser Spectroscopy, Physics Department, Zhong Shan University: "A Practical Optical Multichannel Analyzer"]

[Text] Abstract: An optical multichannel analyzer of a simple construction is presented in this paper. The instrument includes a video camera, a microcomputer and some accessories. It can be used in the measurement of both transient laser optics and transient laser spectroscopy as well as for conventional spectroscopic work.

I. Introduction

In our experiment of picosecond absorption spectroscopy, the transmitted light is recorded by a film placed at the focal plane of a spectrometer. The development of the negative and linear calibration of the emulsion darkness are time consuming and introduce a certain amount of error. Recently we constructed a simple optical multichannel analyzer using a video camera, a microcomputer and some accessories and recorded the spatial distribution of the light intensity. By combining the multichannel analyzer and a spectrometer, the absorption spectral data over a wide wavelength range may be recorded in one flash and the problems associated with films are avoided. The instrument has a better accuracy and can also be used in steady state measurements. Since the instrument is linked to a microcomputer, the processing of the measurement data can be easily achieved with softwares.

II. Description of the Instrument

1. The device

Figure 1 shows a schematic block diagram of the entire optical multichannel analyzer. The video signal from the camera is amplified and its peak value is held by a holding circuit. The signal is converted to a digital signal by an A/D converter and read by the microcomputer. The final output is

printed out by a printer or loaded onto a magnetic disk. The camera is a model SGB-6 simple industrial video camera. The tube is a SF-1303 silicon target video tube with a high sensitivity and a wide spectral response. The microcomputer is a PG-065 machine produced by Zhong Shan University.

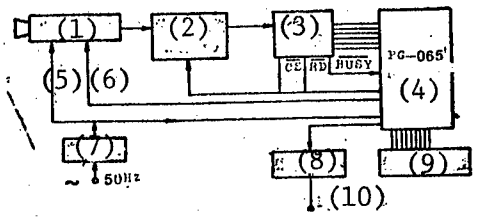


Figure 1. Block diagram of the optical multichannel analyzer

Key:

1. Video camera
2. Amplifier and peak value holding circuit
3. A/D converter
4. Microcomputer
5. Field synchronization
6. Line synchronization
7. Shaping circuit
8. Pulse trigger
9. Printer or disk
10. To laser power source

2. Working principle

The synchronization of the various devices is important in this experiment. We synchronize the computer and the field scan of the camera with the 50 Hz power line signal after shaping. The purpose of using the 50 Hz signal is to make the 50 Hz interference signal stationary on the camera target surface so that the computer may subtract it out as a background. The line scan, the sample and hold circuit and the A/D converter are all computer controlled. If the signal is a pulsed light, the triggering of the light source is also computer controlled and synchronized with the rest of the system. The PG-065 microcomputer has a general purpose interface bus and is suitable for our experiment.

In the measurement of a pulsed light signal, the computer begins in a standby status and the line scan and field scan circuits of the camera are in the free running state so that the electron beam continuously sweeps the target surface for clearing. Once the computer receives the command, it continuously checks the field synchronization signal and becomes aware of the onset of the scan when it receives the synchronization signal. The computer sends out a pulse to trigger the laser during the scan of the electron beam. After a certain time delay, approximately equal to the time required by the laser to turn on, the computer then controls the line scan of the camera and the sample and hold circuit and the A/D converter and collects the data. Figure 2 shows the time sequence of the control signals, all the control signals are low voltage activated. The period of the line scan is 65 μs and each field has 256 scans in a total time of 16.64 ms. Since the inertia of the

camera target is small and the speed of the A/D converter and the computer is low, the gate of the sample and hold circuit only opens twice during one line scan. Therefore, two intensity distribution traces are obtained after each field scan, corresponding to 512 datum points in 256 channels (one line is one channel), as shown in Figure 3. Simultaneously recording two traces of light intensity distribution is adequate for absorption spectrum measurement.

If the light signal to be measured is in a steady state, the above restrictions are not present and the field scan time may be made long enough to record the two dimensional light intensity distribution on the target surface. Furthermore, real time display may be achieved with computer controlled television monitor. The computer acquires a field data and immediately display it on the screen and then proceeds to take another set of field data. The real time variation of the measured light signal can therefore be monitored on the screen. This capability provides great convenience for the adjustment of the equipment and the light path.

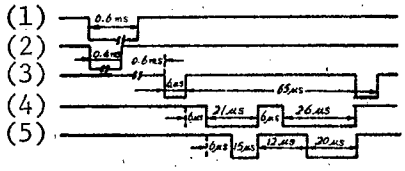


Figure 2. Time sequence of control signals

Key:

1. Field synchronization control pulse
2. Laser trigger pulse
3. Line synchronization control pulse
4. Sample and hold control pulse
5. A/D converter control pulse

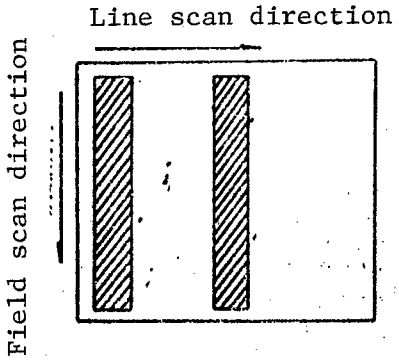


Figure 3. Two traces of light intensity distribution

The acquired light intensity distribution data can be processed immediately and printed out on the printer or stored into a disk. If the computer has no output terminal, the signal may be fed through a D/A converter and plotted on an x-y recorder.

We used an 8-bit A/D converter having a conversion time of 15 μs and working in the successive comparison mode. In order to keep the analog signal to the A/D converter constant during the conversion time, we designed a sample and hold circuit to keep the peak voltage constant during the duty cycle. Figure 4 shows the operation of the sample and hold. Before the input voltage reaches its peak, the output follows the input; after the peak is reached, the output maintains the peak value until the sample and hold is turned off.

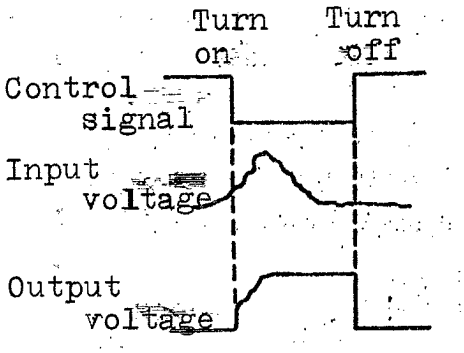


Figure 4. Sample and hold operation

3. Performance evaluation

The silicon target tube in the instrument has a broad spectral response, from 0.4 μ to 1.0 μ, and is adequate for the detection of signals in the visible light. Using an infrared or ultraviolet sensitive camera, one can study the spectra in the infrared or ultraviolet region.

The overall sensitivity of the instrument is determined by the sensitivity of the camera, the resolution of the A/D converter and the signal to noise ratio of the system. The sensitivity of the camera is 0.6 μa/Lx and the resolution of the 8 bit A/D converter is 19.5 mV at a reference voltage of -5 Volts. We measured the dark current noise of the system under no illumination and recorded 30 counts in 30 minutes. The fluctuation of the dark current is less than 19.5 mV and drifts upward.

The spatial resolution of the instrument is determined by the line scan density of the camera. During the data acquisition period, the line scan density is 32 lines per millimeter. When the system is connected to a spectrophotometer, the spectral resolution is determined by the wavelength resolution of the spectrophotometer and the spatial resolution of the instrument.

To evaluate the linear response of the amplifier, the sample and hold circuit, and the A/D converter, we disconnected the video input and connected a stable

voltage to the input. When the input voltage changed from 0 to 5 V, the output voltage responded linearly, as shown in Figure 5, indicating that the linearity of the system (not including the camera) is very good. The linear dynamic range of the camera depends on the operating conditions such as the target voltage, and the conditions of the electron beam, and the videoamplifier. Under optimum conditions, we made measurements using optical attenuators of known transmissivity and found that the output varied linearly with the input video signal amplitude in the 0-5 V range.

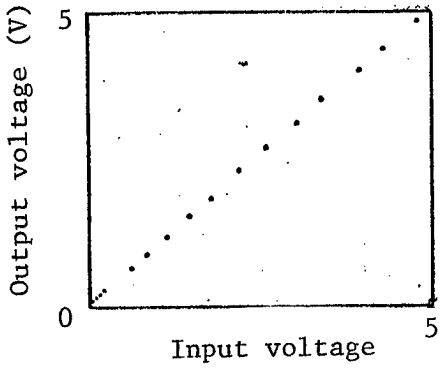


Figure 5. Linear response of the circuit

III. Application Examples

Figure 6 shows the transverse mode distribution of a passive mode locked YAG laser recorded with our multichannel analyzer by aiming the camera at a light spot made by the YAG laser on a diffusive screen. Figure 7(a) is the two-photon fluorescence trace of a pulse from a passive mode locked YAG laser in Rh6G dye. The figure shows that the pulse width of the laser is 40 ps. Traditionally the two-photon fluorescence is recorded on a photographic film in an arrangement shown in Figure 7(b) where the video camera is replaced with a photographic camera. The development and calibration of the film is a tedious chore. With the new method, the data is recorded in one flash and the instrument is superior in recording transient signals.

The spectrographic measurement, we rotated the camera by 90° so that each line sweep corresponds to a wavelength component. (The correspondence is determined by using a standard light source with a known wavelength). The lens of the camera is then removed and the target plane is made to coincide with the focal plane of the spectrophotometer, as shown in Figure 8(b). The stimulated fluorescence spectrum of an argon ion laser in Rh6G dye, with a peak at 5800 Å, is recorded with our apparatus and shown in Figure 8(a). Figures 9 and 10 are respectively the spectrum of the argon ion laser and the Rh6G dye laser. Figure 11 shows the two spectral lines (a doublet) of a mercury lamp at 5461 Å and 5770 A.

The advantage of the apparatus we developed is that it can record the light intensity distribution of a single pulse and it can provide real time display of a continuous light source or a light source with a high repetition rate.

Automatic data processing is achieved by the softwares. However, since the sensitivity of the target surface of the camera is limited, the instrument has some difficulty in recording weak signals. The sensitivity will be greatly improved if an image enhanced camera is used.

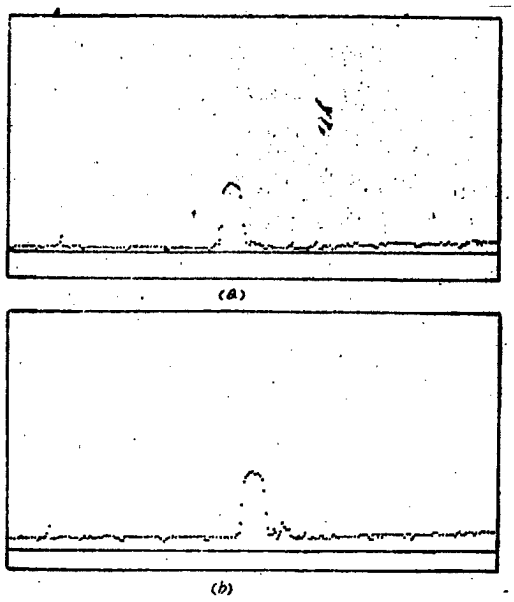


Figure 6. Transverse mode distribution of a passive mode locked YAG laser
(a) Horizontal distribution
(b) Vertical distribution

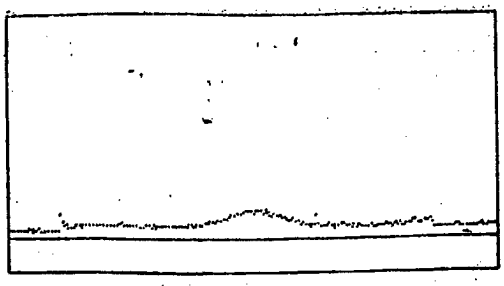


Figure 7(a). Two-photon fluorescence of a passive mode locked YAG laser in Rh6G dye. Trace shows a pulse width of 40 ps.

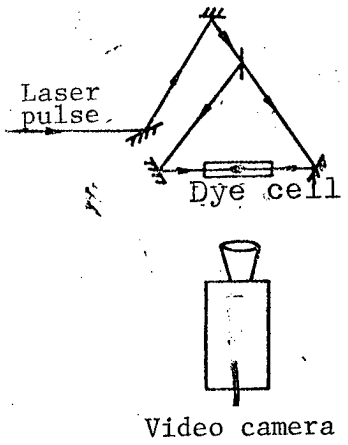


Figure 7(b). Schematic diagram for measuring the laser pulse width using the two-photon fluorescence method

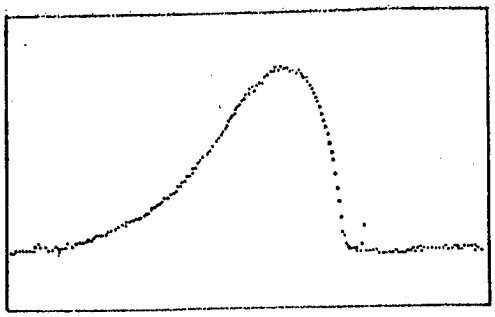


Figure 8(a). Fluorescence spectrum of Rh6G dye

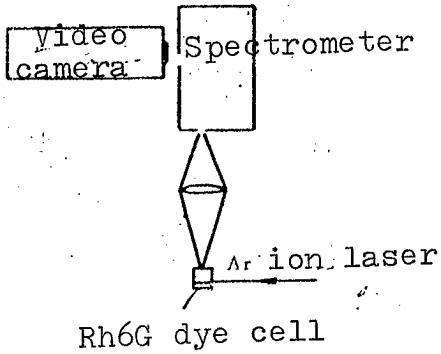


Figure 8(b). Schematic diagram of the setup for measuring the fluorescence spectrum of Rh6G dye

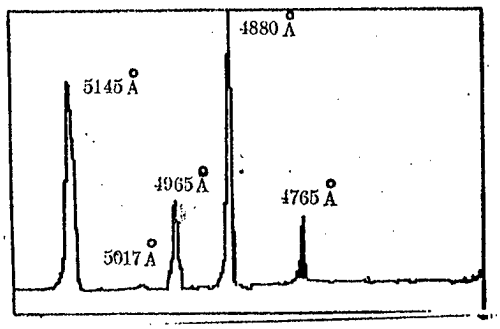


Figure 9. The five spectral lines of the Ar ion laser

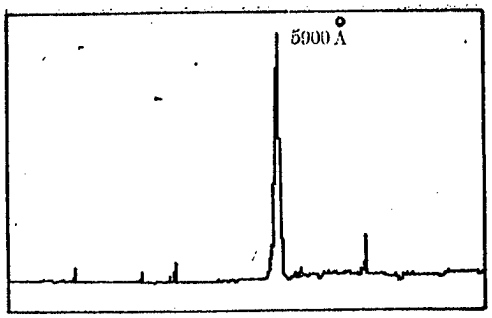


Figure 10. Spectral lines of the Ar pumped Rh6G dye laser

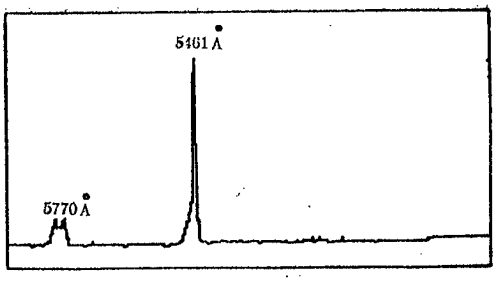


Figure 11. The doublet spectral lines of a mercury lamp

9698
CSO: 4008/283

APPLIED SCIENCES

DEVELOPMENT OF BEAM OPTICS FOR A 200 keV ION IMPLANTER

Wuhan WUHAN DAXUE XUEBAO (ZIRAN KEXUE BAN) [JOURNAL OF WUHAN UNIVERSITY (NATURAL SCIENCE EDITION)] in Chinese No 4, Dec 84 pp 35-40, 56

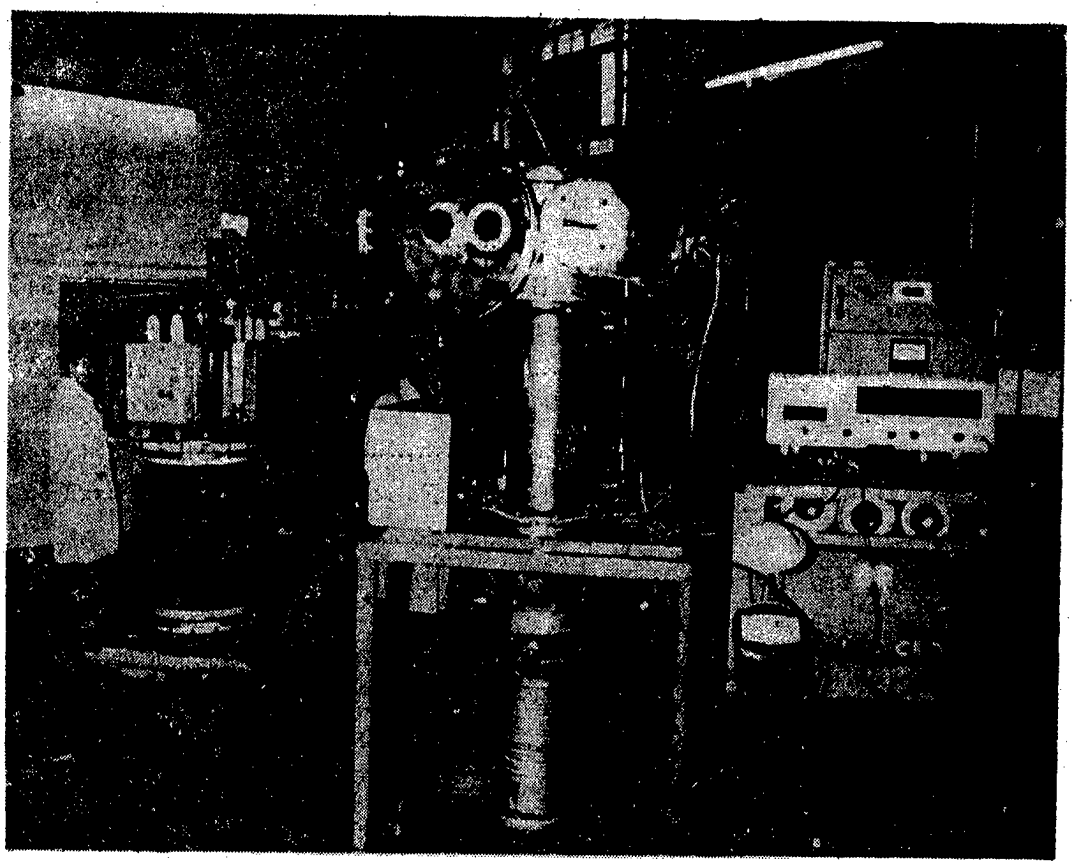
[Article by Pan Xianzheng [3382 7359 2398], Fan Xiangjin [5400 3276 6511], Xu Zaigui [1776 0961 6311], Guo Huaigui* [6753 2037 6311]: "Design and Manufacture of the Beam Optical System for a 200 keV Ion Implanter"]

[Text] Abstract: The beam optics of a 200 keV ion implanter is described in this paper. At present, this ion implanter is used to generate various ion beams of energy ranging from 20-200 keV at mass number $A \leq 50$. It is also used in studying semiconductors and metals.

Ion implantation has been widely used in solid state physics and materials science. It is attractive to build a low energy ion accelerator with a wide tunable energy range which is capable of implanting a large number of ions and is suited for solid material implantation. The design of the ion beam optics system has embraced the merits of similar existing machines both at home and abroad. In addition, we also took our resources and capability into consideration by aiming for low production cost, ease of fabrication, function, and reliability. After several years of hard work, the machine was built and put to use in research and teaching (external view of the machine is shown in the inner cover page 4 as follows).

[external view and Figure 1 on following pages]

* Also worked on the project are Comrades Chu Yuxi [5969 3768 0823], Yang Yezhi [2799 2814 2535], Lu Sansan [7120 3790 3790], Qiu Wanchuan [6726 8001 1556], Zhang Yuanhe [1728 0337 0735], Ye Mingsheng [0673 2494 3932], Chen Houxue [7115 0624 1331], Hou Yan [0230 1484], and Han Guohui [7281 0948 6540].



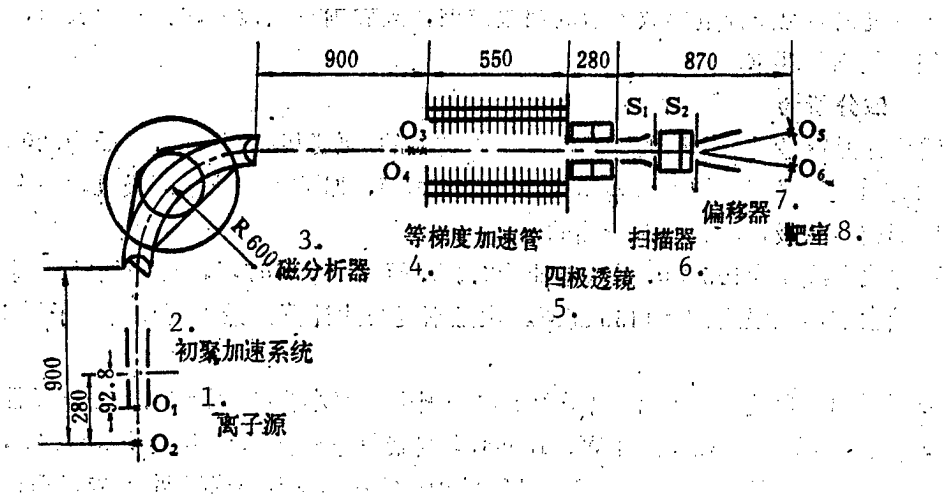


Figure 1. Schematics of the Optics

Key:

1. Ion source
2. Preliminary focusing and acceleration system
3. Magnetic analyzer
4. Equi-gradient accelerator tube
5. Quadrupole lens
6. Scanner
7. Deflector
8. Target chamber

The beam optical system of the machine is schematically shown in Figure 1. The optical path is structured as follows: O_1 is the aperture of the ion source, which is the object point of the preliminary accelerating system. After focusing, a virtual image is formed at the object point of the magnetic analyzer O_2. Then, a real image is formed at O_3 by focusing using the magnetic analyzer. This point is used as the object point of the accelerator tube to form a virtual image at O_4 by focusing. Finally, the quadrupole lens uses O_4 as the object point to project a real image on the target O_5.

The design and testing of various beam optical elements are discussed in the following:

Preliminary Acceleration System

We used a RF ion source with relatively low voltage [1, 2]. In order to increase the initial ion energy and to reduce beam loss, a single-gap double-barrel lens was placed between the ion source and the magnetic analyzer to accelerate the ion beam to 60 keV and to focus it as well. In order to minimize the optical path, to reduce the machine size and to lower the beam loss due to space charge effect, lens parameters were chosen to form a virtual image.

The lens parameters are: double-barrel inner diameter D = 80 mm, gap δ = 0.5D = 40 mm. The distance between the object and the center of the lens p = 1.16D = 92.8 mm. The specified potential ratio of the two electrodes N = 60/4 = 15. The result of lens image formation as calculated by the ion optical equation is shown in Table 1 [3].

Table 1

1. 电压比 N	2. 物方焦距 f_a	3. 象方焦距 f_b	4. 物方焦点位置 F_a	5. 象方焦点位置 F_b	6. 物距 p	7. 象距 q	8. 线放大率 Y_1	9. 角放大率 β
15	0.63	-2.44	-1.51	0.89	-1.16	-3.50	1.80	0.14

Key:
1. Voltage ratio
2. Object focal length
3. Image focal length
4. Object focus location
5. Image focus location
6. Object distance
7. Image distance
8. Linear magnifying factor
9. Angular magnifying factor

The lens parameters were determined by varying the distance between the aperture and the center of the lens and by changing the voltage ratio. The match between adjustments of mechanical assembly and electrical parameters was observed by using a quartz plate at the inlet of the analyzer. It was experimentally demonstrated that this preliminary accelerator is adequate.

Magnetic Analyzer

The mass analyzer is a modified electromagnet. The original electrode was round, 320 mm in diameter. In order to gain a higher resolution, the deflection radius was increased (R = 600 mm). Two sector-shaped boots were added to the electrodes. In addition, a semi-circular rotating magnet was also installed at the boundary for double focusing.

The original coil diameter is 1.5 mm, maximum current 3.5 A, number of turns n = 3667, electrode gap d = 30 mm, and maximum calculated magnetic field strength B = 4456 Gauss.

The analyzer deflection angle φ = 90°, half beam slit angle of the ion beam α_0 = 7°, object distance of the magnetic analyzer l' = 1.5 R, incident angle

$\varepsilon' = 45°$, image distance as calculated by W. Gross's double focus equation [4] $l'' = 1.5$ R, and the ejection deflection angle $\varepsilon'' = -3°$. Linear magnifying factors on two perpendicular planes were found to be $Y_{2x} = -0.6$ and $Y_{2y} = -2.1$, respectively, from the image width based on the formulas given by L. Gartan [5] and M. Cotte [6]. The mass resolution was estimated as $M/\Delta M = 50$.

The double focusing of the beam could be significantly changed by adjusting the rotating electrode. Experimentally, various types of ions below BF, which has a mass number 49, could be separated (see Figure 2).

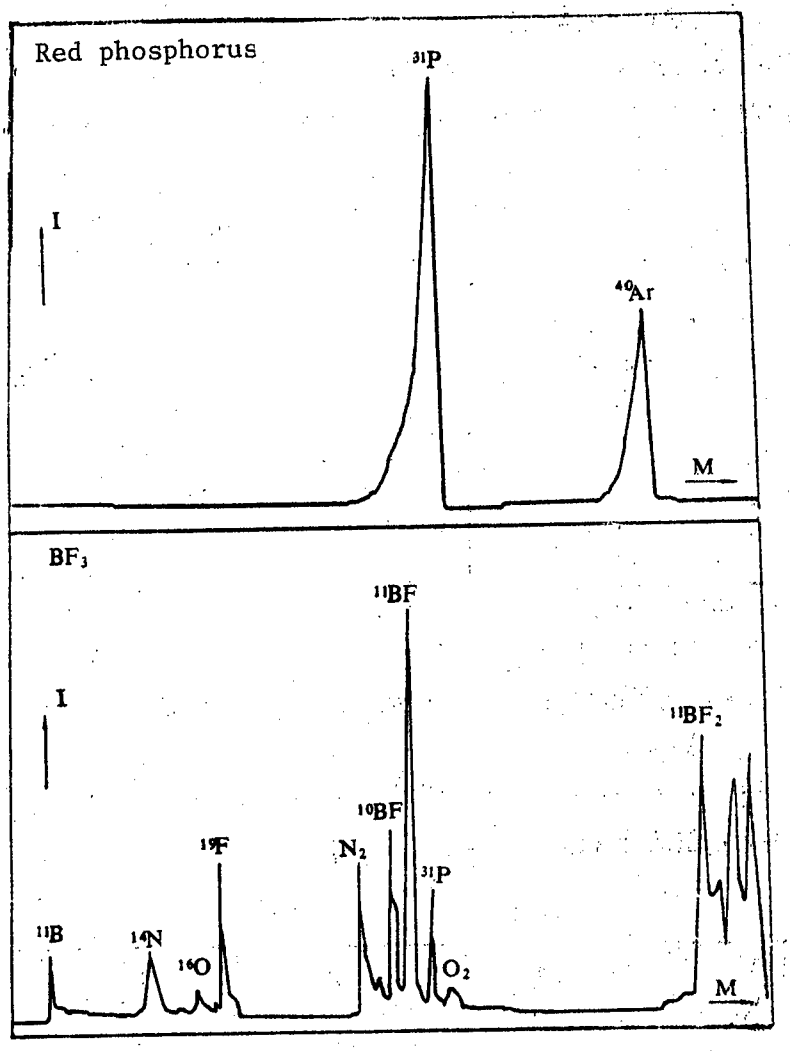


Figure 2. Mass Spectra of Red Phosphorus and BF_3

Accelerator Tube

The pre-accelerator energy was fixed at 60 keV and the energy beyond the analyzer was adjusted by acceleration or deceleration. The rear accelerator tube was equipped with equi-gradient plate electrodes. In order to reduce the ionic draft distance and to shorten the length of the machine, a virtual image was formed by the accelerator tube. The position and size of the image were calculated by using the M. M. Elkind formula [7].

Image Formation by Acceleration

A positive voltage 0-150 kV was applied to the accelerator tube. The ion energy was increased from 60 keV to 210 keV. The voltage ratio was 1-3.5. Results at various energies are shown in Table 2. and Figure 3.

Table 2

Energy E(keV)	90	120	150	180	210
Voltage ratio N	1.5	2.0	2.5	3.0	3.5
$N\frac{D}{L}$	0.27	0.36	0.15	0.55	0.63
Correction factor ξ	1.04	1.03	1.10	1.12	1.14
Image distance $\frac{L_B}{L}$	−1.002	−1.014	−1.018	−1.026	−1.035
Image distance L_B(mm)	−551	−557	−560	−564	−569
Magnifying factor Y_B	0.28	0.33	0.59	0.70	0.83

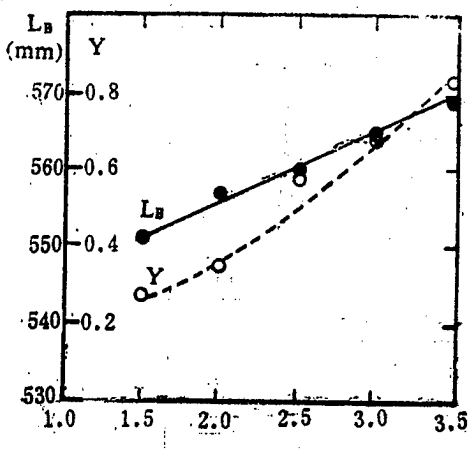


Figure 3. Characteristics of Image Formation by Acceleration

Results of calculation show that the image varies within ±8 mm near the object when the ion energy increases from 60 to 210 keV.

Image Formation by Deceleration

When a negative bias 0-40 kV was applied to the accelerator, the ion energy was decreased from 60 to 20 keV and the voltage ratio was 1-1/3. Calculated results at various energies are shown in Table 3. and Figure 4.

Table 3

Energy E(keV)		50	40	30	20
Voltage ratio N		$\frac{5}{6}$	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{3}$
$N\frac{D}{L}$		0.16	0.13	0.10	0.07
Correction factor	ξ	1.03	1.02	1.01	1.01
Image distance	$\frac{L_B}{L}$	−0.984	−0.994	−1.025	−1.131
	L_B(mm)	− 541	− 547	− 564	− 622
Magnifying factor	Y_3	1.05	1.16	1.22	1.50

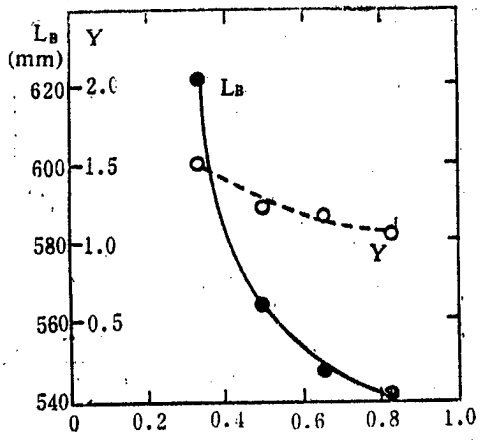


Figure 4. Characteristics of Image Formation by Deceleration

Calculation shows that the image varies in the range of -62 to +19 mm from the object when the ion energy decreases from 60 to 20 keV.

The accelerator is divided into 20 segments. It was made of 100 mm inner diameter stainless steel electrodes and bonded with 25 mm high hard glass insulating rings. The electric field gradient in the accelerator is 3 kV/cm. The resistance and electric field are homogeneous. There was no sign of sparking.

Electrostatic Quadrupole Lens

Because a virtual image is formed by the accelerator, the ion beam is moving toward the target chamber in a divergent manner. Furthermore, when the accelerating bias is adjusted, the position of this virtual image also varies. In order to obtain a well-focused ion beam on the target at a fixed distance, a strongly focusing quadrupole lens was used as the projection lens. Its parameters were selected to match the accelerator. When the ion energy is in the 20-210 keV range, the object distance of the quadrupole lens varies between -622 to -541 mm. A scanner and a deflector were installed between the quadrupole lens and the target chamber and the image distance of the lens was chosen to be 870 mm.

We used a double element electrostatic quadrupole lens and its parameters are as follows:

electrode length l_o = 112 mm,

electrode radius R = 1.15a = 26 mm,

effective electrode length $l = l_o + 1.14A$ = 138 mm,

field intensity parameter $kl = \frac{l}{a}\sqrt{\frac{V}{E}}$

effective inscribed circle radius of the electrode a = 23 mm,

effective electrode gap s = 0.

The optical characteristics of the lens were calculated using the curves and data provided by H. A. Enge [8].

Table 4

Ion energy (keV)	Object distance p(mm)	Image distance q(mm)	Field intensity parameter $(k_1 l)^2$	$(k_2 l)^2$	Lens voltage $V_1(V)$	$V_2(V)$	Magnifying factor Y_{4C}	Y_{4D}
210	569	870	0.83	0.78	4880	4590	-0.6	-2.8
50	541	870	0.85	0.80	1190	1120	-0.7	-2.9
20	622	870	0.82	0.77	460	430	-0.5	-2.1

Calculations show that because the image distance does not vary significantly by design, i.e., the object distance of the lens does not vary by much and the field intensity of the lens remains more or less the same, V-E is approximately linear.

Electrostatic Scanner and Deflector

The scanner board and deflector parameters were calculated using the formulas given in reference [9], and the results are shown in Tables 5. and 6.

Table 5

Scanner	Length a_1 (mm)	Length a_2 (mm)	Gap d_1 (mm)	Gap d_2 (mm)	Width b (mm)	Scanning angle α	Scanning distance l (mm)	Scanning range $\pm D$ (mm)	Scanning frequency f (Hz)	Accelerating bias V_a (kV)	Scanning voltage V (kV)
S_1	66	40	20	24	80	1°52′	720	±25	1000	200	2.50
										20	0.25
S_2	80	60	20	26	80	2°21′	540	±25	2—4	200	2.50
										20	0.25

Table 6

Length a (mm)	Gap d_1 (mm)	Gap d_2 (mm)	Width b_1 (mm)	Width b_2 (mm)	Deflection angle α	Deflecting electrode distance L (mm)	Deflection displacement $\pm D$ (mm)	Accelerating bias V_a (kV)	Deflecting bias V (kV)
200	40	106	80	120	±7.5°	280	±50	200	17.20
								20	1.72

The electrodes of the entire electrostatic quadrupole lens-scanner-deflector assembly were mounted on four pieces of 20 mm diameter, 850 mm long stainless steel tubes linked together by flanges to form an "optical bench". Then, it was sealed in a 200 mm inner diameter, 850 mm long seamless steel pipe to ensure accuracy as well as to reduce vacuum joints.

In order to deflect neutral beams and to improve performance, the polarity of the deflector electrodes was changed to allow the ion beam to deflect symmetrically by $\pm 7.5°$ to enter two different target chambers. One of the target chambers was equipped with a rotating rack for eight targets. Seven 50 x 50 mm^2 targets could be installed at a time. A Faraday tube and an electrode to suppress secondary electrons were installed in front of the target chamber to improve the accuracy in measuring the ion beam. The other target chamber was scheduled for high and low temperature targets and back-scattering measurement equipment.

Conclusions

Since the construction of this machine, the design requirements had been met after a long time in operation. The adjustable energy range is 20-200 keV. The ionic current ranges from 1-100 μA. The beam diameter is 5 mm. The scanning area is 50 x 50 mm^2. The non-uniformity is $\leq$ 10 percent. It has met the needs for many experiments. Over the years, we collaborated with other units to develop solid state devices such as silicon solar cells [10], high frequency transistors, germanium avalanche diodes, integrated circuits and magnetic bubbles, as well as to perform research on laser annealing of radiation damage [11] and ion beam mixing [12]. In addition, in response to the requests of several plants, we conducted preliminary experiments on ion implantation into metals for corrosion resistance, erosion resistance and fatigue resistance.

BIBLIOGRAPHY

1. Cheng Shichang [4453 0013 2490], Fan Xiangjun and Guo Huaixi [6753 2037 0823], WUHAN DAXUE XUEBAO (ZIRAN KEXUE BAN) [JOURNAL OF WUHAN UNIVERSITY (NATURAL SCIENCE EDITION)] No 4, 1980 p 59.

2. Yang Yezhi [2799 2814 2435], Lu Shanshan [7120 2790 2790] and Guo Huaixi, WUHAN DAXUE XUEBAO (ZIRAN KEXUE BAN) [JOURNAL OF WUHAN UNIVERSITY (NATURAL SCIENCE EDITION)] No 4, 1980 p 64.

3. Beijing Radiation Center and Institute of Low Energy Nuclear Physics at Beijing Normal University, FUNDAMENTALS OF ION IMPLANTATION, Beijing Publishing House, 1982 p 88.

4. W. Gross, Rev. Sci. Instr., 22 (1951) 717.

5. L. Gartan, J. Physique Rad., 8 (1937) 453.

6. M. Cotte, Ann. Physique, 10 (1938) 333.

7. M. M. Elkind, Rev. Sci. Instr., 24 (1953) 129.

8. H. A. Enge, Rev. Sci. Instru., 3, 4 (1959) 248.

9. M. R. Mulianglofu, ELECTRON BEAM DEVICES, National Defense Industry Publishing House, 1959 pp 85, 91

10. Li Jinchai, Xu Zaigui and Qiu Wanchuan [6726 5502 1557], TAIYANGNENG XUEBAO [ACTA ENERGIAE SOLARIS SINICA] Vol 1, No 1, 1980.

11. Pan Xianzheng, Yang Yezhi and Xu Zaigui, Symposium of the Second National Electron Beam, Ion Beam and Light Beam and Ultramicro-technology Conference, 1952 p 132.

12. Qiu Wanchuan, Chen Jin [7115 3866] and Sun Xifang [1327 5045 2455], ZHENKONG KEXUE YU JISHU [VACUUM SCIENCE AND TECHNOLOGY] Vol 3, No 6, 1983 p 439.

12553
CSO: 4008/288

'CHARACTERISTIC VALUE' AS AN ENERGY OUTPUT INDEX FOR EXPLOSIVES

Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 84 pp 36-42

[Article Zhang Housheng [1728 0624 3932] and Zhang Shanshan [1728 3790 3790]

Text] Abstract. The "characteristic value" of an explosive and the method of computing it are described and equations for computing the detonation velocity, detonation pressure, specifid kinetic energy of detonation products, specific impulse, dent depth, ballistic mortar value, cylinder-test specific kinetic energy, penetration depth, Gurney velocity and flying plate velocity are derived. These equations have some advantages over the existing equations. It is believed that the energy output index of an explosive should have a functional relationship to the detonation parameters and measures of explosive work. The characteristic value satisfies the requirements for an energy output index and may be so used.

1. Introduction

Determining the energy output indices of an explosive is usually considered important for two reasons: (a) providing data that enables users to select explosives; (b) suggesting approaches in the synthesis of new explosives.

An energy output index should have a functional relationship to detonation parameters and to measures of explosive work (the work done by a detonation or explosion). The simplest type of functional relationship is of course a linear relationship. We believe that only such indices can correctly express the energy output of explosives in different types of device. Since explosives are used in different ways and in different devices, their energy output is likely to vary. In order to measure the various energy output characteristics of an explosive, various experimental techniques have been developed (including modeling experiments); as a group, the results are called "explosive work values" or "explosive work characteristics". But in the case of explosives in the research stage, and particularly the "new explosives" that are being designed, no wide variety of tests is performed. For the purposes of research organizations involved in the synthesis of new explosives, if an energy output index generally meets the above requirements, it is acceptable.

In the past, investigators studying explosives have used the heat of detonation, various detonation parameters, and various measures of explosive work as energy output characteristics, but these characteristics do not meet the requirements described above for an energy output index. Below we propose the use of the "characteristic value" (CV) of an explosive as an energy output index; the computation results indicate that it satisfies the requirements for an energy output index.

2. The Characteristic Value and Ways of Calculating It

The relationship of the detonation velocity and detonation pressure to and the factors governing them is presented in tables 2.1 and 2.2.

Table 2.1 Relationship of detonation velocity to the principal factors governing it.

表2.1 炸药的爆速与其主要影响因素的关系

	a 爆速计算公式		爆热 b Q	爆容 c V	密度 d ρ_0	其他 e	文献 f
g	流体力学公式	$D=\sqrt{2(K^2-1)Q}$	$Q^{1/2}$			K	〔1〕
h	NMQ公式	$D=(1.011+1.312\rho_0)\varphi^{1/2}$ $\varphi=NM^{1/2}Q^{1/2}$	$Q^{1/4}$	$(N^{1/2})$	ρ_0	$M^{1/4}$	〔2～4〕
i	nQ公式	$D=4.2+2.0\rho_0\varphi_{\Pi.\Pi.}$ $\varphi_{\Pi.\Pi.}=nQ^{1/2}$	$Q^{1/2}$	(n)	$\rho_0(\rho_0^{1.6})$		〔5〕
j	作者设想	$D=F(\rho_0Q^{1/2}V^{1/2})$	$Q^{1/2}$	$V^{1/2}$	ρ_0		

Key:
a. Detonation velocity equations
b. Heat of detonation Q
c. Detonation Volume V
d. Denisty ρ_0
e. Other
f. Source
g. Fluid-dynamic equation
h. NMQ equation
i. nQ equation
j. Authors' proposed equation

Table 2.2. Relationship of detonation pressure to the principal factors governing it.

表2.2 炸药的爆轰压与其主要影响因素的关系

a 爆轰压计算公式	爆热 b Q	爆容 c V	密度 d ρ_0	其他 e	文献 f
g 流体力学公式 $p=\rho_0D^2/(K+1)=2(K-1)\rho_0Q$	Q		ρ_0	K	[1]
h NMQ公式 $p=15.58\rho_0^2\varphi$	$Q^{1/2}$	(N)	ρ_0^2	$M^{1/2}$	[2~4]
i nQ公式 $p=40.0+75\rho_0^2\varphi$ п.л.	$Q^{1/2}$	(n)	$\rho_0^2(\rho_0^2\cdot^5)$		[5]
j 密度平方公式 $p=\alpha\rho_0^2$			ρ_0^2	α	[6]
k 作者设想 $p=F(\rho_0^2QV)$	Q	V	ρ_0^2		

Key:
a. Detonation pressure equations
b. Heat of detonation Q
c. Detonation volume V
d. Density ρo
e. Other
f. Source
g. Fluid-dynamic equation
h. NMQ equation
i. nQ equation
j. Density-squared equation
k. Authors' proposed equation

It can be seen from these tables that there are various contradictions between the equations used to calculate these quantities, and accordingly we propose the use of new equations, which are on the bottom line of each table. These proposed measures have a common factor, the product of the heat of detonation per unit volume of explosive ($\rho_0 Q$) and the detonation volume per unit volume of explosive ($\rho_0 V$), or the square root of this product. These proposed equations embody the relationship of blast pressure and detonation velocity to the principal factors that govern them, such as heat of detonation, detonation volume and packing density, and in also express the relationship of blast pressure to the square of the detonation velocity. We call the product that appears in the equations the "characteristic value" (CV) ω,

$$\omega = \rho_0 Q \cdot \rho_0 V = \rho_0^2 Q V$$

where ω is in cal/cm^3; ρ_0 is the packing density of the explosive, g/cm^3, Q is the heat of detonation cal/g, and V is the detonation volume.

It is evident from the dimensions of the CV that it is related to the energy per unit volume of explosive, and accordingly it can be used as a measure of the latter.

Either experimental or computed values can be used for the packing density, detonation volume and heat of detonation when computing the CV. The detonation

volume and heat of detonation of a single-component explosive are calculated from the B-W (Brinkley-Wilson) law. For greater clarity, the detonation volumes and heats of detonation for explosives with the formulas $C_aH_bN_cO_d$ and $C_aH_bN_cO_dF_e$ are listed in Tables 2.3 and 2.4.

Table 2.3. Detonation volume and heat of detonation of $C_aH_bN_cO_d$ explosives

表2.3 $C_aH_bN_cO_d$炸药的爆容和爆热

a 氧平衡	$V/(10^3 cm^3 \cdot g^{-1})$	$Q/(10^3 cal \cdot g^{-1})$
$d \geqslant 2a + \frac{b}{2}$	$5.6(b + 2c + 2d)/m$❶	$(28.9b + 94.05a + \Delta H_f^0$❷$)/m$
$2a + \frac{b}{2} > d > a + \frac{b}{2}$	$11.2(2a + b + c)/m$	$(67.63d - 41.21a - 4.915b + \Delta H_f^0)/m$
$a + \frac{b}{2} \geqslant d > \frac{b}{2}$	$11.2(c + 2d)/m$	$(15.69b + 26.42d + \Delta H_f^0)/m$
$\frac{b}{2} \geqslant d$	$11.2(b + c)/m$	$(57.8d + \Delta H_f^0)/m$

❶ m—炸药的分子量； ❷ ΔH_f^0—炸药的生成焓 (kcal/mol)。

Key: a. Oxygen balance

Footnotes to table: 1. m is the molecular weight of the explosive
2. ΔH_f^o is the enthalpy of formation of the explosive (kcal/mole)

Table 2.4. Detonation velocity and heat of detonation for $C_aH_bN_cO_dF_e$ explosives

表2.4 $C_aH_bN_cO_dF_e$炸药的爆容和爆热

a 氧平衡	$V/(10^3 cm^3 \cdot g^{-1})$	$Q/(10^3 cal \cdot g^{-1})$
$2a + \frac{b}{2} \geqslant d + \frac{e}{2} \geqslant a + \frac{b}{2}$	$11.2(2a + b + c + e)/m$	$(67.63d + 69.715e - 41.21a - 4.915b + \Delta H_f^0)/m$
$a + \frac{b}{2} > d + \frac{e}{2} \geqslant \frac{b}{2}$	$11.2(c + 2d + 2e)/m$	$(15.69b + 26.42d + 49.11e + \Delta H_f^0)/m$
$\frac{b}{2} > d + \frac{e}{2}$	$11.2(b + c + e)/m$	$(57.8d + 64.8e + \Delta H_f^0)/m$

Key: a. Oxygen balance

It should be noted that the computed values of the detonation volume and heat of detonation of fluorine-containing explosives given in Table 2.4 are conditional and apply only when $e < b$; when $e > b$, different equations must be used.

For mixed explosives, the detonation volume and heat of detonation are calculated in terms of the concentrations of the components. In the explosives considered in this paper, the combined concentration of the explosive ingredients is at least 90 percent. Although binders, plasticizers and other components have some effect on the detonation volume and heat of detonation, they are present in small amounts and may be neglected.

3. Use of the Characteristic Value as an Energy Output Index

3.1 Relationship of Characteristic Value to Detonation Parametors Characteristics

3.1.1. We studied the relationship of the CV to the detonation velocity for 62 explosives and 372 detonation velocity measurements and found that it can be expressed by the equation

$$D = 3.231\,\omega^{1/2} + 2641 \qquad (3.1)$$

where D is the detonation velocity (m/sec).

The detonation velocities for certain common explosives calculated from equation (3.1) are presented in table 3.1.

Table 3.1. Measured and calculated values of detonation velocities of explosives

表3.1 炸药爆速的实测值与计算值

a 序号	b 炸药	$\rho_0/(g\cdot cm^{-3})$	$D/(m\cdot s^{-1})$[2] (实测值) c	$\omega/(10^6 cal\cdot cm^{-3})$	$D/(m\cdot s^{-1})$ (计算值) d	e 误差 (%)
1	TNT	1.64	6950	1.957	7161	-3.0
2	TNB	1.64	7270	1.963	7168	1.4
3	TNA	1.72	7300	2.060	7279	0.3
4	DATB	1.79	7575	2.293	7534	0.6
5	TATB	1.859	7900	2.379	7625	3.5
6	Tetryl	1.70	7560	2.453	7702	-1.9
7	TNETB	1.78	8450	3.176	8400	0.6
8	BTNEN	1.96	8850	3.310	8520	3.7
9	BTNEU	1.86	9000	3.558	8736	2.9
10	EDNA	1.663	8237	2.946	8137	0.6
11	DNPN	1.73	8100	2.955	8196	-1.2
12	HMX	1.90	9100	4.000	9104	0.0
13	RDX	1.80	8754	3.586	8760	-0.1
14	R盐 salt	1.57	7800	2.646	7897	-1.3
15	PETN	1.77	8600	3.417	8614	-0.2
16	DINA	1.67	8000	2.860	8105	-1.3

Key: a. Number
b. Explosive
c. (measured)
d. (calculated)
e. Error, %

The average computation error for the detonation speeds calculated from equation (3.1) is ±2.52% and the correlation coefficient is 0.942.

3.1.2. We studied the relationship of the detonation volume to the CV for 28 explosives and 132 detonation volume measurements and found that it could be expressed by the equation

$$p = 9.378 \times 10^{-5} \omega + 15.96 \qquad (3.2)$$

where p is the detonation pressure (10^8 Pa [pascals]).

Detonation pressure values calculated from equation (3.2) are presented in Table 3.2.

Table 3.2 Measured and calculated values of detonation volume of explosives

表3.2 炸药爆轰压的实测值与计算值

a 序号	b 炸药	ρ/(g·cm⁻³)	c p/(10⁸Pa) c (实测值)	d 文献	ω/(10⁶cal·cm⁻³)	p/(10⁸Pa) e (计算值)	误差 f (%)
1	TNT	1.64	210	[5]	1.957	199.5	5.0
2	RDX	1.802	347	[5]	3.594	353.0	-1.7
3	HMX	1.90	393	[2]	4.000	391.1	0.5
4	PETN	1.77	335	[5]	3.417	336.4	-0.4
5	BTF	1.901	360	[5]	3.567	350.5	2.7
6	FEFO	1.599	250	[5]	2.473	247.8	0.9
7	TNA	1.60	176	[7]	1.782	183.1	-4.1
8	TNB	1.64	219	[2]	1.963	200	8.6
9	EDNA	1.532	265.9	[8]	2.500	250.4	5.8
10	PA	1.63	191.5	[9]	1.749	180.0	6.0
11	NG	1.592	253.0	[2]	2.708	269.9	-6.7
12	Tetryl	1.70	263	[2]	2.453	246.0	6.5

Key: a. Number
b. Explosive
c. (measured)
d. Source
e. (calculated)
f. Error (%)

The average calculation error for the detonation volume calculated from equation (3.2) was ±6.85% and the correlation coefficient was 0.964.

3.1.3. Wu Xiong [0702 7160] and Lin Rushan [2651 1172 1472] used the specific kinetic energy of the detonation products ($\frac{1}{2} u_j^2$, BKW method, program in FORTRAN) as a basis for evaluating the detonation parameters of explosives. The relationship between the specific kinetic energy of the detonation products and the CV is expressed by the equation

$$\tfrac{1}{2} u^2_j = 4.339 \times 10^{-7} \omega + 0.852, \qquad (3.3)$$

where U_j represents the particle velocities of the explosive (mm/μsec).

The calculation results obtained with equation (3.3) are presented in Table 3.3.

Table 3.3. Computation of specific kinetic energy of detonation products

a 序号	b 炸药	$\rho_0/(g\cdot cm^{-3})$	$\frac{1}{2}U_j^2/(10^3 m\cdot s^{-1})^2$	c 本文 $\omega/(10^6 cal\cdot cm^3)$	c 本文 $\frac{1}{2}U_j^2/(10^3 m\cdot s^{-1})^2$ (计算)	误差d (%)
1	HMX	1.89	2.563	3.958	2.570	-0.3
2	RDX	1.77	2.378	3.467	2.357	0.9
3	PETN	1.76	2.258	3.378	2.318	-2.7
4	Tetryl	1.62	1.832	2.228	1.819	0.7
5	TNT	1.63	1.616	1.933	1.691	-4.6
6	NM	1.14	1.536	1.491	1.499	2.4
7	HMX/TNT80/20	1.821	2.343	3.401	2.328	0.6
8	RDX/TNT77/23	1.754	2.234	3.115	2.204	1.4
9	RDX/TNT64/36	1.717	2.107	2.833	2.082	1.2
e	平均计算误差(±%)					1.64

Key: a. Number
b. Explosive
c. Authors' figures
d. (calculated)
e. Error (%)
f. Average calculation error (±%)

It can be seen from the table what when the specific kinetic energy was calculated with this equation, the mean computation error was ±1.64% and the correlation coefficient was 0.994.

3.2. Relationship of CV to Measures of Explosive Work

Bu using mathematical induction, we obtained a series of equations for measures of explosive work in terms of the CV, as shown in Table 3.4.

Table 3.4. Equations relating measures of explosive work to characteristic value

a 序号	b 爆炸功	c 量纲	d 爆炸功与示性值的关系式	e 炸药种类	数据数目	计算误差 f(±%)	g 相关系数	h 备注
1	i 比冲量	%	$I = 0.02889\rho_0\omega^{1/2} + 22.27$	6(6)❶	24[10]	1.97	0.990	TNT/RDX 50/50，$\rho_0 = 1.68$ 时的比冲量为100%
2	j 炸痕深度	%	$B_I = 4.045\times10^{-5}\omega + 20.55$	23(5)	29[11]	3.37	0.970	TNT $\rho_0 = 1.633$ 时深度为100%
3	k 弹道臼炮值	%	$W = 1.392\times10^{-4}\omega - 12.58$	65(46)	69[8]	7.08	0.843	$\rho_0 = 1$ 以TNT为100%
4	l 圆筒试验比动能(法线)	$\frac{1}{2}$(mm/μs)²	$E_{cyl\text{-}H} = 3.424\times10^{-7}\omega + 9.53\times10^{-2}$	16(5)	16[12]	3.39	0.979	
5	m 圆筒试验比动能(切线)	$\frac{1}{2}$(mm/μs)²	$E_{cyl\text{-}T} = 4.092\times10^{-7}\omega + 0.203$	16(5)	16[12]	3.23	0.978	
6	n 侵彻深度	mm	$L = 4.672\times10^{-5}\omega + 30.79$	8	8[1]	3.63	0.915	
7	o Gurney速度	mm/μs	$\sqrt{2E_g} = 8.804\times10^{-4}\omega^{1/2} + 1.234$	9(6)	11[13]	1.66	0.968	

❶ 圆括弧中的数字为单质炸药的种类。

Key:
a. Number
b. Measure of explosive work
c. Dimensions
d. Relationship of parameter to characteristic value
e. Type of explosive
f. Number of data values
g. Calculation error (±%)
h. Correlation coefficient
i. Remarks
j. Specific impulse
k. Dent depth
l. Ballistic mortar value
m. Specific kinetic energy in cylinder test (normal line)
n. Specific kinetic energy in cylinder test (tangent line)
o. Penetration depth
p. Gurney velocity
q. Specific impulse is 100% for TNT/RDX 50/50 with $\rho_0 = 1.68$
r. The dent depth is 100% for $\rho_0 = 1.633$
s. Equal to 100% for TNT with $\rho_0 = 1$.

Footnote to table: Figures in parentheses are for single-component explosives

As can be seen in the table, the correlation coefficients for these equations are all very close to 1, so that they have rather high reliability.

It should also be pointed out that the equations for explosive work characteristics all apply to specific devices and specific conditions. It

is particularly clear from the measurements of the shaped charge penetration depth that if the configuration of the charge is changed, the resulting change in penetration depth is considerable.

In addition to the equations for the abovementioned detonation effectiveness characteristics, we also found an equation for the flying plate velocity,

$$U_f = A\omega 1/2 + B \qquad (3.4)$$

where U is the flying plate velocity (10^3 m/sec), and A and B are constants.

The mean error in computing the flying plate velocity with equation (3.4) was $\pm$0.94% and the correlation coefficient was 0.991.

Pepekin and Lebedev [5] give a different equation for the specific impulse,

$$I = 37.8 + 36.5\,\rho_0\varphi \qquad (3.5)$$

where I is the specific impulse (%), ρ_0 is the packing density of the explosive (g/cm^3), and φ is a standard value used in calculating detonation paramaters.

The results obtained from equation (3.5) within its range of applicability (explosive packing density equal to at least 95 percent of its real density) are compared with the results obtained by our proposed method in Table 3.5

Table 3.5. Comparison of methods for calculating specific impulse

a 序号	b 炸药	$\rho_0/(g\cdot cm^{-3})$	c 比冲量 (实测) (%)	d 文献	e 本文 比冲量 (计算) f (%)	e 本文 误差 g (%)	h 文献[5] 比冲量 (计算) f (%)	h 文献[5] 误差 g (%)
1	RDX	1.802	121.0	[5],[11]	120.9	-0.1	122.5	-1.2
		1.80	119.3	[11]	120.7	-1.2	122.5	-2.7
		1.77	114.0	[11]	117.5	-3.1	121.1	-6.2
		1.75	113.0	[11]	115.3	-2.1	120.1	-6.3
2	TNT	1.62	84.0	[11]	86.9	-3.5	85.2	-1.5
		1.60	83.6	[5],[11]	85.4	-2.1	84.6	-1.2
		1.58	82.0	[11]	83.8	-2.2	84.1	-2.5
3	PETN	1.77	117.4	[5],[11]	116.8	0.5	113.4	3.4
		1.73	113.0	[11]	112.6	0.4	111.7	1.2
		1.68	111.0	[11]	108.4	2.3	109.9	0.9
4	DINA	1.63	100.1	[11]	100.0	0.1	104.9	-4.8
		1.63	100.0	[11]	100.0	0.0	104.9	-4.9
		1.67	103.9	[5],[11]	103.9	0.0	106.6	-2.6
		1.59	96.0	[11]	96.2	-0.2	103.3	-7.6
5	TNT/RDX50/50	1.68	100.0	[5],[11]	99.9	0.1	99.9	0.1
		1.60	94.2	[11]	92.7	1.6	97.0	-3.0
i	16组平均计算误差					±1.22	--	±3.13

Key:
a. Number
b. Explosive
c. Specific impulse (measured),%
d. Source
e. Present authors
f. Specific impulse (calculated),%
g. Error (%)
h. Pepekin and Lebedev [5]
i. Average computation error for 16 sets of values

It can be seen from the table that our equations have a wider range of applicability than equation (3.5), and that the computation is more precise and convenient.

All of our equations relating measures of explosive work to the CV exhibit excellent functional relationships. We may therefore conclude that the CV meets the requirements for an energy output index for explosives and can be so used.

Acknowledgements. During the work, Comrades Dong Haishan [5516 3189 1472], Sun Mingzhen [1327 0682 2182], Tian Qingzheng [3944 3237 2398] and Liu Zhenyuan [0491 2182 3293] discussed various problems with us; we take this occasion to express our gratitude.

BIBLIOGRAPHY

1. Price, C. Chem. Ref., 59(5), p 801 (1959).

2. Kamlet, M. J. et al. J. CHEM, PHYS., 48, No 23, 26, 43, p 3685 (1968)

3. KAMLET, M. J., et al. AD-661483 (1967)

4. Kamlet, M. J., et al. ISRAEL J. TECHNOLOGY, 7, No 43 (1975)

5. Pepekin, V. I., and Yu. A. Lebedev. DAN SSSR [Doklady Akademii nauk SSSR], 234, No 6, p 1391 (1977).

6. Johansson, C. H., and P. A. Persson. NATURE, 212, 1230 (1966)

7. Coleburn, N. L., and T. P. Liddiard. J. CHEM. PHYS., Vol. 44, 1929 (1966)

8. Fedoroff, B. T. et al. "Encyclopedia of Explosives and Related Items," Vols. 1-7

9. Kistiakowsky, G. B., and E. B. Wilson. OSRD, No 114 (1941)

10. Apin, A. Ya., et al. VZRYVNOYE DELO, 52/9, 90, Gosgortekhizdat, Moscow, 1963

11. Smith, L. D. EXPLOSIVESTOFFE, 15, No 5, p 106 (1967)

12. Dobratz, B. M. UCRL-51319 (1974)

13. Hardesty, D. R., and J. E. Kennedy. COMB. AND FLAME, 28, No 1, 45 (1977)

8480
CSO: 4008/304

APPLIED SCIENCES

LONG WAVE (1.2-1.5 um) SEMICONDUCTOR LASERS

Beijing TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS] in Chinese No 1, Jan 84 pp 68-71

[Article by Pan Zhonghau [3382 0022 3185], Yang Guisheng [2799 2710 3932], Ran Chongzhu [0373 1504 4554], Zhao Songshan [6392 1529 1472], and Wang Yuzhang [3769 3768 4545], Wuhan Posts and Telecommunications Research Institute]

[Text] Abstract. Long-wave semiconductors lasers are important light sources for high-capacity fiber-optic communication systems with long repeater spacings. Lasers with outputs at 1.2, 1.3 and 1.5 μm, power feedback and temperature feedback systems for them, and techniques for coupling their output into single-mode optical fibers are described.

1. Structure of InGaAsP Double Heterojunction Semiconductor Laser

Double heterojunction [DH] epitaxial chips were produced by liquid phase epitaxy and cooling; under strictly controlled process conditions, we repeatedly obtained various types of epitaxially grown chips with good lattice matching, bright surfaces, uniform thickness, flat interfaces, and output wavelengths from 1.2 to 1.52 μm. Oxide isolation and deep diffusion of zinc were used to produce stripe-geometry lasers with continuous wave room-temperature output at the above wavelengths. Fig. 1 shows the structures of two typical n-p-p and n-n-n double heterojunction laser chips.

Oxide-confined stripe-geometry lasers were produced by growing an SiO_2 film about 2000 Å thick on an n-p-p epitaxial wafer, photoetching the groove for the stripe, evaporating an Au-Zn allow onto the wafer, thinning the substrate, evaporating an Au-Sn alloy onto the opposite side, electroplating, cleaving into dice, and bonding the chips that pass the pulse test to a heat sink, resulting in an oxide-confined stripe-geometry laser. N-n-n epitaxial wafers are used for deep zinc diffusion stripe-geometry lasers. Zinc diffusion of the wafer in a closed ampoule following photoetching produces the stripe structure; the other processes are similar to those used for the oxide-confined stripe-geometry laser.

(Figures 1 and 2 on following page)

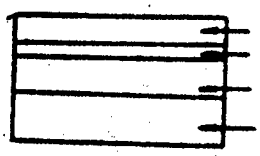


Fig.1. Epitaxial Chip Structure

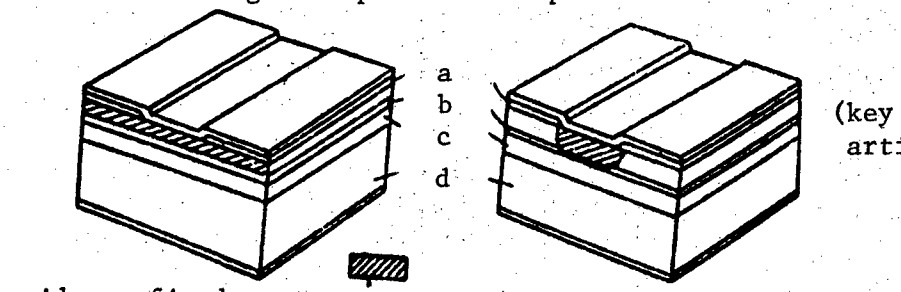
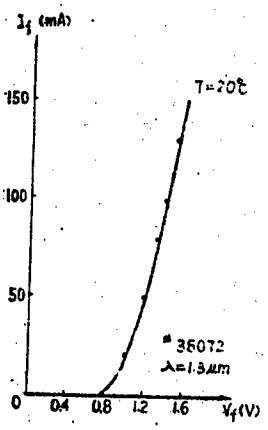


Fig. 2. Structure of Laser Chips

2. Optical and Electronic Characteristics of InGaAsP Semiconductor Lasers

The finished semiconductor lasers have typical diode characteristics. Fig. 3 shows the forward I-V characteristic for a device with a wavelength of 1.3 μm. It is evident from the figure that the on-state voltage drop V_D at a forward current of 0.1 mA is about 0.8 V and that the differential resistance at 150 mA is about 2 ohms. V_D depends on the components of the active layer. It is slightly

Fig. 3



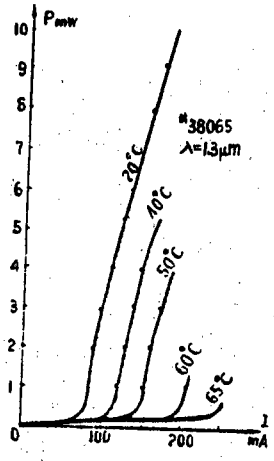


Fig. 4

higher for a laser with a 1.2-μm output and slightly slower for a laser with a 1.5-μm output. Fig. 4 shows the P-I characteristic for a deep zinc diffusion stripe-geometry laser. It can be seen that the continuous wave laser output power at room temperature can be as high as 10 mW, and that the output characteristic has no kink. The electrooptic conversion efficiency $\Delta P/\Delta I$ is about 20% and continuous lasing occurs even at an ambient temperature of 65° C. When the heat sink temperature is increased by high ambient temperatures, a rise in the junction temperature can cause the threshold current I_{th} to rise.

Fig. 5

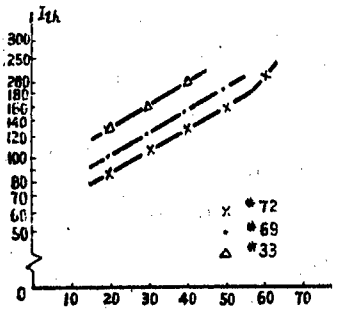


Fig. 5 shows a plow of the threshold current versus the heat sink temperature for DC operation. Near room temperature, a 10° C increase in the heat sink temperature causes an increase of about 20-30% in the threshold current. Fig. 4 shows that when the working current is maintained constant, a 1° rise in the heat sink temperature causes a drop of 0.2 mW in the output power. For high efficiency coupling of the optical output into an optical fiber, as much as possible of the output power should be concentrated in a rather narrow cone; this heightens the requirements regarding the far-field distribution of the radiated power. An InGaAs measuring device fabricated by us was used to determine the spatial distribution curve of the optical power by spatial scanning measurements. Fig. 6 shows the horizontal and vertical far-field patterns for a typical deep zinc diffusion layer.

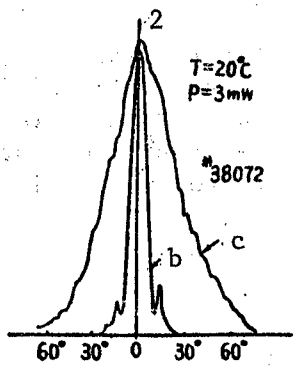


Fig. 6

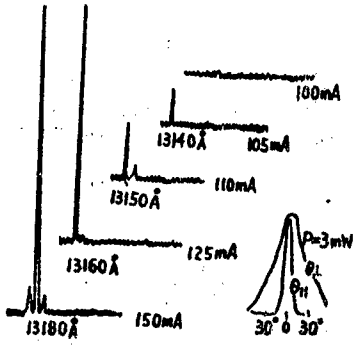


Fig. 7

In several dozen trial-produced laser specimens the maximum horizontal lobe half-power width was 15°, the minimum 7.5° and the average 12.3°; the maximum vertical lobe half-power width was 50°, the minimum 36° and the average 45.2°. Thus in all cases these lasers' radiative power had a single transverse mode distribution, and large changes in the output power caused essentially no change in the far-field pattern; this avoids the modulation distortion that results from changes in the optical intensity distribution. The optical spectrum characteristics of these semiconductor lasers expressed the longitudinal mode structure of the cavity. The deep zinc diffusion stripe-geometry lasers had four types of output spectra, I, II, III and IV [3]. Spectrum type I, shown in Fig. 7, has a single longitudinal mode structure and the line half width is about 2 Å. In continuous-wave operation, single longitudinal mode output is maintained even when I/I_{th} exceeds 1.5; when I/I_{th} increases gradually from a value of 1, owing

to an increase in the junction temperature, as the cavity dimensions are increased the width of the forbidden band continually narrows, so that the output spectrum shifts slightly toward longer wavelengths. The figure also shows the far-field pattern for this laser. During the tests we observed that stable fundamental transverse mode operation provided the necessary conditions for single longitudinal mode operation. Spectral type II, shown in Fig. 8, has a multiple longitudinal mode structure, with a group of 14 longitudinal modes. The mode spacing $(\Delta\lambda)g$ is about 10 Å. Above the half-power point there are 6 longitudinal modes with a spectral width of about 50 Å. During the tests we observed that with a relative long cavity, if the mode spacing $(\Delta\lambda)g$ was small more wavelengths could be emitted, producing a multiple longitudinal mode output. In addition, if the far-field pattern showed multiple peaks, or if the chip uniformity was poor, a chastic longitudinal mode output could easily result. In order to measure the high-speed operating characteristics of the lasers, we used a trial-produced InGaAs photodiode to measure the optical pulse output of the lasers. As shown in Fig. 9, the electrical pulse halfwidth was about 1 ns. Subtracting the oscilloscope bandwidth and the effect of the front and rear edges of the electrical exciting pulses, this confirmed that the combined response time of the test-produced long-wave laser and the detector was less than 1 ns. The test-produced lasers' working frequencies were divided into three groups: 1.2, 1.3 and 1.5 μm. The acceptable lasers were able to operate steadily in the continuous-wave mode. An optical output power of 2 mW at room temperature was maintained normally for 10,000 hours.

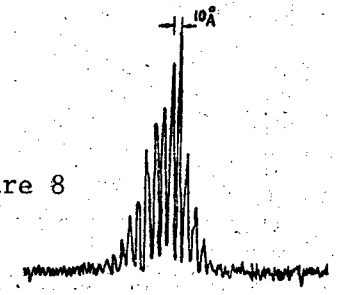


Figure 8

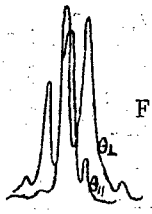
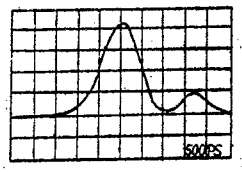


Figure 9



3. Some Problems in the Application of InGaAsP Lasers

The characteristic temperature T_0 of InGaAsP lasers is rather low. The output power with DC injection at room temperature generally shows considerable fluctuation. Fig. 10 shows plots of output power versus time for several randomly selected specimens. In order to achieve a steady output power and make the devices usable, negative optical power feedback can be used. As shown in Fig. 11, laser light falling on a p-i-n detector produces a photoelectric current, which is passed through a phase-inverting amplifier I and injected into the laser. This negative feedback loop effectively increased output power stability. When it was used, the rate of change of the optical power output over time was

$$\frac{dp^1}{dt'} = \frac{1}{1+A_1A_2A_3} \quad \frac{dp}{dt}$$

where A_1 is the p-i-n detector's photoelectric conversion efficiency, A_2 is the gain of the phase-inverting aplifier, and A_3 is the laser's electroptic conversion

efficiency. The characteristics of the negative optical feedback device that we developed were: $A_1 \approx 5\text{-}10\ \mu A/mW$, $A_2 = 4 \times 10^4$, $A_3 \approx 0.1$ mWmA. Thus $A_1A_2A_3$ is between 20 and 40, and adjustment during assembly can achieve a steady gain of about 30, which is equivalent to decreasing the size of the fluctuations in the output power by a factor of 30.

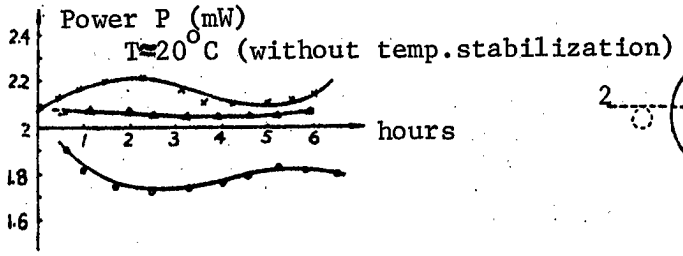


Fig. 10

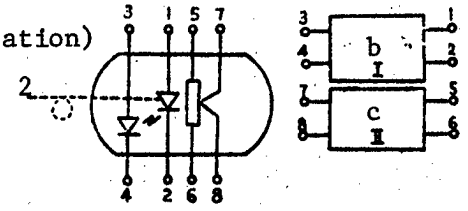


Fig. 11

In order to make the semiconductor lasers operate more stably, in addition to optical output feedback it is also possible to use negative temperature feedback. The forward voltage of the lasers described above is about 1.5 V, and in continuous wave operation about 200 mW of electric power is largely converted into heat. We found during tests that if the laser was connected to a power supply at room temperature, the temperature at point A on the heat sink shown on Fig. 2 rose rapidly to about 50°C. If the ambient temperature increased, point A became even warmer, and the P-I curve shifted further to the right (see Fig.4). Although the negative optical power feedback described above can maintain an essentially constant power output, an increase in the ambient temperature unavoidably increases the injection current, so that the operating wavelength and transverse mode structure will be changed. It is desirable to use negative temperature feedback to further improve the laser's operating stability. The temperature sensor shown in Fig. 11 converts temperature to electric current, which is passed through amplifier II and fed to the semiconductor cooling unit; the resulting closed negative feedback loop tends to keep the laser's heat sink temperature constant. If A_4 is the conversion factor of the temperature sensor, A_5 is the transfer factor of amplifier II, and A_6 is the transfer factor of the semiconductor cooling unit, then the open-loop temperature change ΔT and the closed-loop temperature change $\Delta T'$ are related by the equation

$$\Delta T' = \frac{1}{1+A_4A_5A_6}\ \Delta T$$

In the arrangement shown in Fig. 11, for $A_4A_5 \approx 200$ mA/°C and $A_6 \approx 0.1$°C/mA, tests showed that $\Delta T'/\Delta T$ was about 0.05, and that combining negative temperature feedback with negative optical output power feedback could greatly improve the operating stability of the laser.

Compared with multimode fiber optic systems, long-wave single-mode fiber-optic systems have a much greater transmission capacity and repeater spacing because multimode dispersion is eliminated. Because the core diameter of a single-mode fiber is much less than the numerical aperture, the coupling methods usual with multimode fibers are very ineffective with single mode fibers. Ref. 2 reports the design and manufacture of miniaturized optical components to couple the

optical output power of semiconductor lasers efficiently into single-mode fibers. But this approach is too complex and costly. We decided to use single convex lenses made by self-melt forming, which are easy to manufacture. With the semiconductor laser described in the previous section, we measured the long and short axes of the waist of a gaussian beam as 2.6 μm and 0.49 μm. Using a single-mode fiber with an optical spot radius of 6 μm, we made a numerical calculation of the values of r_L (the radius of curvature of the lens) and Z (the distance between the laser and the fiber), which are the key factors in the coupling system. The set of curves which we obtained indicated that for reasonable values of r_L and A the coupling efficiency may be as high as 30-40 percent [4]; accordingly we use melting and supplementary etching to manufacture single-mode end fibers with microlenses. Fig. 13 shows the laser P-I characteristic before and after coupling. It is evident that the experimental results are basically in agreement with the theoretical calculations. The coupling efficiency below the threshold value is extremely low because the fluorescence component does not readily enter a single-mode fiber.

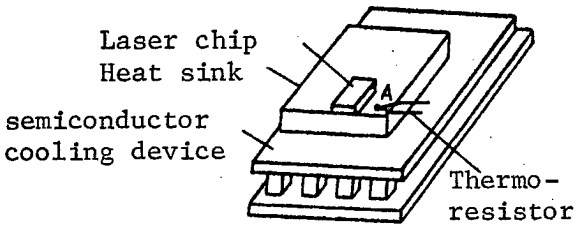


Fig. 12

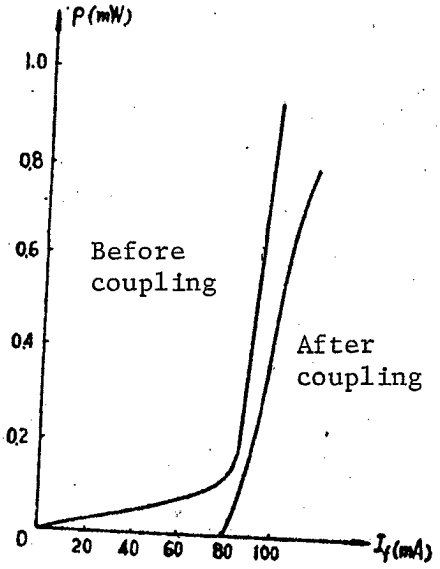


Fig. 13

BIBLIOGRAPHY

1. JIEEE, QE-17, No 2, p 18.
2. JIEEE, QE-16, No 10, p 1059.
3. "1980 quannian bandaoti jiguangqi he faguang qijian xueshu taolunhui lunwenji" [Collected Papers from the 1980 National Conference on Semiconductor Lasers and Light-Emitting Devices].
4. "Some Topics in the Use of Long-Wave Semiconductor Lasers," in "1982-nian guangxian tongxin zhuanyong qijian yu jicheng guangxue xueshu jiaoliuhui lunwen" [Papers from the 1982 Specialized Fiber-Optic Communications Devices and Integrated Optics Conference]

Key: a. Dielectric layer
b. Active layer
c. Buffer layer
d. Substrate

Fig. 3. Forward volt-ampere characteristic of laser

Fig. 4. Continuous-emission P-I characteristic of deep zinc diffusion stripe-geometry laser

Fig. 5. DC threshold voltage vs heat sink temperature

Fig. 6. Far-field pattern for deep zinc diffusion stripe-geometry laser emissions

Key: a. Relative light intensity
b. Horizontal
c. Vertical

Fig. 7. Optical spectrum characteristic and far-field pattern of layer (cavity length 200 μm)

Fig. 8. Optical spectrum characteristic and far-field pattern of laser (cavity length 300 μm)

Fig. 9. Laser pulse response

Fig. 10. Output power vs time for randomly selected laser chips

Fig. 11. Diagram of semiconductor laser assembly. 1, 2. Semiconductor laser; 3, 4. p-i-n detector used for monitoring; 5,6. Semiconductor cooling device; 7,8. Temperature sensor

Key: a. Optical fiber
b. Phase-inverting amplifer I
c. Amplifier V

Fig. 12. Temperature control arrangement

Fig. 13. P-I curves for laser

8480
CSO: 4008/290

APPLIED SCIENCES

COUPLING BETWEEN SPINOR FIELD, PROPAGATING TORSION

Wuhan WUHAN DAXUE XUEBAO (ZIRAN KEXUE BAN) [JOURNAL OF WUHAN UNIVERSITY (NATURAL SCIENCES EDITION)] in Chinese No 1, [Mar] 84 pp 47-50

[Article by Xu Jizhong [1776 3444 0112]: "Coupling of Spinor Field and Propagating Torsion"]

[Text] Abstract: In this article we discuss the coupling of the spinor field and propagating torsion. We point out that there is no interaction between the spinor field and torsion in the HRRS theory, and in DG theory the action of torsion on Dirac particle is expressed as a modification of Dirac particle rest-mass and the torsion produced by the sun makes a contribution of less than 2×10^{-46}U on the rest mass of the Dirac particle on the earth.

Einstein-Cartan gravitational theory is a natural extension of Einstein's gravitational theory. This theory is based on the extension of Riemann space time in general theory of relativity to Riemann-Cartan space-time, that is the coefficient of connection is

$$\Gamma_{ij}^{k} = \left\{ {k \atop ij} \right\} - K_{ij}^{k} \qquad (1)$$

in which $\left\{ {k \atop ij} \right\}$ is Christoffel symbol, and K_{ij} is the group torsion tensor, and its relationship with torsion tensor $S_{ij} = \frac{1}{2}(\Gamma_{ij}^{k} - \Gamma_{ji}^{k})$ is

$$K_{ij}^{k} = -S_{ij}^{k} - S^{k}{}_{ij} + S_{j}^{k}{}_{i} \qquad (2)$$

In this theory, the gravitational field is not only described as metric tensor g_{ij}, but also as torsion. Thus for gravitational field equations not only is there a metric tensor equation, but there is also a torsion field equation related to spin angular momentum[1]. The latter is an algebraic equation, not a dynamics equation, thus this torsion field cannot be propagated in a vacuum, and at the same time, this torsion does not couple with photons. S. Hojman et al., (HRRS, for short)[2] and most recently, V. DeSabbata and M. Gasperini (DG for short)[3] separately stated the theory of propagation of torsion in a vacuum. Their primary differences are: (i) in HRRS theory, electromagnetic coupling with field and time-space geometry is minimal, but with the scalar field it is not minimal coupling; and in DG theory, the coupling between the electromagnetic field and torsion is semi-minimal (also called

"indirect" coupling, i.e., between the torsion and the photons there is minimal coupling due to the ponderable fermion produced in response to vacuum polarization effect), and between it and the scalar field there is minimal coupling. (ii) In HRRS theory, torsion tensor is taken as

$$S_{ij}{}^{k} = \frac{1}{2}(\varphi_{,j}\,\delta_i^k - \varphi_{,i}\,\delta_j^k) \qquad (3)$$

this torsion not only produces electric flow, but magnetic flow, as well; in DG theory, the torsion tensor is taken as

$$S_{ij}{}^{k} = \frac{1}{2}\,E^{k}{}_{ijl}\,\varphi^{,l} \qquad (4)$$

this torsion produced only electric flow, and not magnetic flow. Here, φ is torsion potential, indicated as "," expresses the general derivative, and $E_{ijkl} = \sqrt{-g}\,\varepsilon_{ijkl}$, ε_{ijkl} is the Levi-Civita symbol. (iii) In HRRS theory, the relationship between the torsion potential φ produced on the earth by the sun and the Newtonian potential U is $\varphi \sim 0.67 \times 10^{-10} U$. The acceleration of bodies of different electromagnetic capacities in the gravitational field of the sun and the earth is different and this does not conform to the Eotvos-Dicke-Braginskii experimental results of the equivalent principle.[4] In DG theory, if the sun's magnetic field is caused by the spinning uniform arrangement of the atomic nuclei within it, then the relationship of Newtonian gravitational potential U and the dipole torsion potential φ produced at a location r remote from it is

$$\varphi \sim 0.6 \times 10^{-10}\frac{U}{r} \qquad (5)$$

non-polarized bodies (i.e., those in which the spinning arrangement of all particles is chaotic) of different elements fall at a similar speed in the gravitational field of the sun and earth, and this is uniform with the results of all recent equivalency principle experiments.

The goal of this article is to discuss coupling of the spinor field and the above-mentioned propagation torsion. We will point out that the Dirac equation in HRRS theory and the Dirac equation in general theory of relativity are completely uniform, this means that torsion and Dirac particle do not interact. In DG theory we will see that the contribution of torsion plays a correcting role on the rest mass (or rest energy) of the Dirac particle. Yet the existence of torsion does not destroy the spiral nature of neutrinos.

In Einstein-Cartan theory, the function of the spinor field ψ can be written[5]

$$S_{\psi} = -\frac{1}{8\pi}\int\Big[i\Big(\bar{\psi}\,r^{\mu}\overset{(\,)}{\nabla}_{\mu}\psi - \overset{(\,)}{\nabla}_{\mu}\bar{\psi}\,r^{\mu}\psi\Big) - 2m\,\bar{\psi}\psi$$
$$+\frac{i}{4}K_{\mu\beta\alpha}\bar{\psi}\,(r^{\mu}r^{\beta}r^{\alpha} - r^{\alpha}r^{\beta}r^{\mu})\psi\Big]\sqrt{-g}\,d^4x \qquad (6)$$

in which $\overset{\{\}}{\nabla}_\mu \psi$ is the covariant derivative of spinor ψ in Riemann space; γ^μ is the Dirac matrix; and

$$K_{\mu\beta\alpha} = g_{\alpha\nu} h_\beta{}^j h_\mu{}^i h^\nu{}_k K_{ij}{}^k \qquad (7)$$

here we introduce the biaojia [2871 2665] field $h_\alpha{}^i$ and the existence under the following conditions:

$$g^{ij} = g^{\mu\nu} h_\mu{}^i h_\nu{}^j$$

$$g^{\mu\nu} = diag(-1, -1, -1, +1) \qquad (8)$$

in the above formulae, the Latin letters indicate the coordinate notation and the Greek letters indicate the biaojia notation.

Carrying out variation of (6) for $\bar{\psi}$ we get the Dirac equation

$$ir^\mu \overset{()}{\nabla}_\mu \psi + \frac{i}{8} K_{\mu\beta\alpha}(r^\mu r^\beta r^\alpha - r^\alpha r^\beta r^\mu)\psi - m\psi = 0 \qquad (9)$$

and when we substitute (2), (3), and (7) in (9) we have

$$ir^\mu \overset{()}{\nabla}_\mu - m\psi = 0 \qquad (10)$$

This is the Dirac equation in HRRS theory, and it is completely identical to the Dirac equation in general theory of relativity, therefore, torsion and the Dirac particles in HRRS theory do not interact, and the Dirac particle cannot produce this kind of torsion field nor can it be used to examine the existence of such a torsion field.

In addition, substituting (2), (4), and (7) in (9) we can obtain the Dirac equation in DG theory as below:

$$ir^\mu \overset{()}{\nabla}_\mu \psi - \frac{3i}{4} \varphi_{,\mu} r^5 r^\mu \psi - m\psi = 0 \qquad (11)$$

To discuss the influence of the torsion field on the Dirac particle, first of all, we must temporarily ignore the metric field, thus (11) can be written

$$ir^\mu \partial_\mu \psi - \frac{3i}{4} \varphi_{,\mu} r^5 r^\mu \psi - m\psi = 0 \qquad (12)$$

at the same time we can only consider the situation in which the static torsion field and the ion field source are remote, then $\varphi_{,\mu}$ can be processed as a constant vector, thus the plane wave is solved as

$$\psi = u(p) e^{i(p_4 x_4 - p_1 x_1 - p_2 x_2 - p_3 x_3)} \qquad (13)$$

and substituting (13) in (12) we get

$$\left(-r^4 p_4 + r^a p_a - \frac{3i}{4} \varphi_{,a} r^5 r^a - m\right) u(p) = 0 \qquad (a = 1, 2, 3) \qquad (14)$$

expressed by Dirac matrix as

$$r^1=\begin{pmatrix}0&0&0&1\\0&0&1&0\\0&-1&0&0\\-1&0&0&0\end{pmatrix},\quad r^2=\begin{pmatrix}0&0&0&-i\\0&0&i&0\\0&i&0&0\\-i&0&0&0\end{pmatrix},\quad r^3=\begin{pmatrix}0&0&1&0\\0&0&0&-1\\-1&0&0&0\\0&1&0&0\end{pmatrix},$$

$$r^4=\begin{pmatrix}1&0&0&0\\0&1&0&0\\0&0&-1&0\\0&0&0&-1\end{pmatrix},\quad r^5=\begin{pmatrix}0&0&-i&0\\0&0&0&-i\\-i&0&0&0\\0&-i&0&0\end{pmatrix}.$$

(14) gives

$$\begin{pmatrix} -p_4-m+\frac{3}{4}\varphi_{,3} & \frac{3}{4}(\varphi_{,1}-i\varphi_{,2}) & p_3 & p_1-ip_2 \\ \frac{3}{4}(\varphi_{,1}+i\varphi_{,2}) & -p_4-m-\frac{3}{4}\varphi_{,3} & p_1+ip_2 & -p_3 \\ -p_3 & -p_1+ip_2 & p_4-m-\frac{3}{4}\varphi_{,3} & -\frac{3}{4}(\varphi_{,1}-i\varphi_{,2}) \\ -p_1-ip_2 & p_3 & -\frac{3}{4}(\varphi_{,1}+i\varphi_{,2}) & p_4-m+\frac{3}{4}\varphi_{,3} \end{pmatrix} \times \begin{pmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \end{pmatrix} = 0 \qquad (15)$$

We take the resting coordinate system of the particle (i.e., $p_1 = p_2 = p_3 = 0$) and make the third axis orientation $\vec{\nabla}\varphi$ (i.e., $\varphi_{,1} = \varphi_{,2} = \vec{\nabla}^1$)[6], then the solution to the system determinant of (5)

$$p_4 = \pm m \pm \frac{3}{4}\varphi_{,3} \qquad (16)$$

The second element on the right above is correction of the function of the torsion field on the rest mass (or rest energy) of the particle. If the magnetic field of the sun is entirely stimulated by the ordered arrangement of the spinning of the atomic nuclei inside it, then the contribution of the torsion field it produces on the earth's which can be obtained by (5) is

$$\frac{3}{4}\varphi_{,3}\sim\frac{3}{4}\times 6\times 10^{-20}\,\frac{U}{D^2}\sim 2\times 10^{-48}\,U \qquad (17)$$

in which D is the distance between the sun and the earth, and U is the Newtonian potential. If the magnetic field of the sun is not completed stimulated by the uniform arrangement of the spin of the atomic nuclei inside it, then $\frac{3}{4}\varphi_{,3}<2\times10^{-46}\,U$.

Because the first element and second element in equation (11) has a nature identical to the A. Salam transformation, and the neutrino field equation under the bound condition $\psi = ir^5\psi$ can be divided into a two component spinor equation, and thus the existence of this torsion does not destroy the spiral nature of the neutrinos.

References

1. F. W. Hehl, P. von der Heyde, G. D. Kerlick, and J. M. Nester, REV. MOD. PHYS., 48(1976) 393.

2. S. Hojyman, M. Rosenbaum, M. P. Ryan, and L. C. Shepley, PHYS. REV., D17 (1978) 3141.

3. V. De Sabbata and M. Gasperini, PHYS. REV., D23 (1981) 2116.

4. W-T. Ni, PHYS. REV., D19 (1979) 2260.

5. F. W. Hehl and B. K. Datta, J. MATH. PHYS., 12(1971) 1334.

6. M. P. O'Connor and P. K. Smrz, AUSTRALIAN J. PHYS., 31(1978) 95.

8226
CSO: 4008/287

SOLVENT RESIN METHOD TO SEPARATE ISOBUTENE PASSES TECHNICAL EVALUATION

Lanzhou HECHENG XIANGJIAO GONGYE [SYNTHETIC RUBBER INDUSTRY] in Chinese No 6, Nov 84 p 462

[Article by Meng Tao [1322 3325]: "Solvent Resin Method To Separate Isobutene Passes Technical Evaluation"]

[Text] Research on the solvent resin method to separate isobutene carried out by the Lanhua Company's Institute of Chemical Engineering passed the 2-liter and 7-liter model technical evaluation on 25 May 1984.

At the meeting, a total of 10 technical reports, including testing under industrial conditions, solvent recovery, initial dynamics research, analytical method research, and preliminary evaluation of technical economics were read. The research results were: after adding polar solvent to strong acid 732 resin catalyst produced by the Nankai University Chemical Engineering Plant and the Dandong Chemical Engineering Plant, under industrial conditions of reaction temperatures of 50-90°C, reaction pressure of 20 kg/cm^2 (meter pressure), water to solvent weight ratio of (50-30):(50-70), C_4 and liquid volume ratio of 1:(3-5), and air speed of 1-1.5 $hours^{-1}$, when the isobutene content in the C_4 fraction was less than 40 percent, after the two stage hydration reaction, the overall transformation rate of isobutene was $>$99.3 percent, overall selectivity was $>$95 percent, and the isobutene content in the remaining C_4 was $<$0.5 percent, the purity of the isobutene produced was 99.9 percent. The solvent used could be reused.

The results of this test reached the levels of similar research abroad, and were characterized technically by small amount of pollution, light corrosion, and high degree of purity of isobutene product, and the remaining C_4 could be used as raw material for butene oxidative dehydrogenation. Research work is continuing to improve this technological line daily.

8226
CSO: 4008/286

APPLIED SCIENCES

SYNTHESIS OF TELECHELIC LIQUID CHLOROPRENE RUBBER BY PHOTOCHEMICAL METHOD

Lanzhou HECHENG XIANGJIAO GONGYE [SYNTHETIC RUBBER INDUSTRY] in Chinese No 4, Jul 84 pp 260-263

[Article by Cao Zehuan [2580 3419 3883], Zhou Xuehong [0719 7185 7703], Dai Mingde [2071 2494 1795] and Li Dehe [2621 1795 0735], Department of Chemical Engineering, Shandong College of Chemical Engineering: "Synthesis of Telechelic Liquid Chloroprene Rubber by the Photochemical Method"]

[Text] Telechelic liquid polychloroprene is currently synthesized mainly by solution polymerization and emulsion polymerization. Since these two methods use assistants and solvents during polymerization, it not only causes trouble for after-processing, but also influences the quality and performance of the product. To overcome these shortcomings, we used the photochemical method to synthesize xanthic acid zhi [7927] telechelic liquid chloroprene rubber (XLCR).

Experimental Part

I. Raw Material

2-chloro-1, 3-butadine, polymer level, a product of the Qingdao Chemical Industry Plant. Regulator butyl, an industrial product, melting point 45°C. Isopropryl alcohol, chemically pure, boiling point 82.5±1°C. Antioxidant 2246, industrial product, melting point 79-84°C.

II. Polymerization Method

The polymerization reaction was carried out in a specially manufactured photochemical reactor, and after-processing of the rubber liquid was carried out in the conventional method. The regulator butyle in the rubber liquid was extracted using isopropryl alcohol.

III. Analysis and Testing

Using the VPO method, the molecular weight of the XLCR was measured using a model QX-08 gas-phase penetration meter.[1,2] Medium tolerance performance and aging performance were measured according to Ministry standards HG-846-76 and HG-845-76, respectively. Physical and mechanical performance were measured according to State standard GB-531-76.

Results and Discussion

I. Factors Influencing Polymerization Reaction

Influence of polymerization temperature: As can be seen from Figure 1, as the polymerization temperature increased, the monomer transformation and molecular weight of XLCR increased along with it. However, when the polymerization temperature got too high, at the light source it readily became gelatin. Generally 40-50° was selected as best.

Influence of polymerization time: From Figure 2 it can be seen that as the polymerization time increased, the monomer transformation rate and XLCR molecular weight had a tendency to slowly increase. Generally, monomer transformation rate was controlled at 70-80 percent, and at this time, the polymerization time was 14-17 hours.

Influence of quantity of regulator butyl used: From Figure 3 it can be seen that as the quantity of regulator butyl used increased, the monomer transformation rate and the molecular weight of XLCR both decreased at the same time. To ensure a certain monomer transformation rate, the XLCR molecular weight was generally controlled to within the range of 2000-3000, and at this time, the quantity of regulator butyl used should be 8-12 percent.

II. Performance Comparison

From Tables 1 and 2 it can be seen that the tensile strength, extensibility, and shear strength are all superior to the similar Japanese product X-100 rubber, but is slightly inferior in terms of permanent strain; in oil and strong acid resistance it is better than X-100 rubber, in heat and electrical resistance it is the same as X-100 rubber, but in water and heat aging performance it is inferior to X-100 rubber.

III. Applications Results

1. The Shanghai Electric Cable Plant use of XLCR to test manufacture deep water marine sealed electric cable showed that the physical and mechanical performance was superior to X-100 rubber, insulation resistance conformed to Ministry standards, sealing performance was superior to products made of neoprene. However, XLCR still has the disadvantage of strong odor and inferior manipulativity.[3]

2. The Shenyang No 4 Rubber Plant used XLCR for cementing tests of cotton to cotton, synthetic to synthetic, natural rubber to natural rubber, and natural rubber to neoprene rubber. The tests showed that XLCR has possibilities to become a non-solvent adhesive.

3. The Chemistry Department of Shandong University used XLCR as a shiwen [1358 3306] vulcanized liquid silicon rubber modifier, and results of use indicate that XLCR and silicon rubber used together can improve the laceration strength of silicon rubber and can lower manufacturing costs.

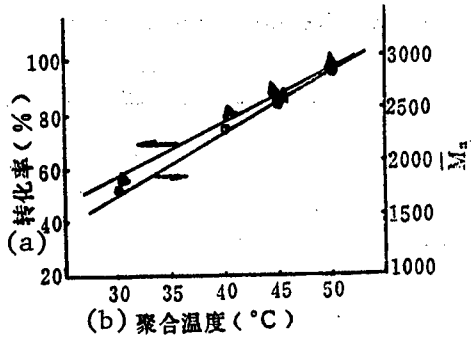


Figure 1. Influence of polymerization temperature on polymerization reaction Polymerization conditions: regulator butyl used was 10 percent (by weight), polymerization time was 16 hours.

Key:

a. Transformation rate

b. Polymerization temperature (°C)

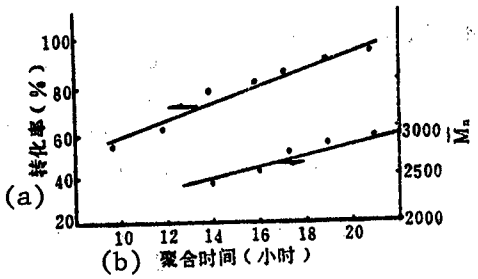


Figure 2. Influence of polymerization time on polymerization reaction Polymerization conditions: regulator butyl used was 10 percent (by weight), polymerization temperature was 40°C.

Key:

a. Transformation rate

b. Polymerization time (hours)

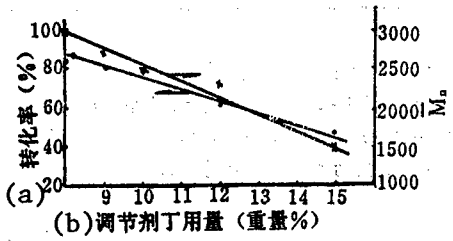


Figure 3. Influence of regulator butyl used on polymerization reaction Polymerization conditions: polymerization temperature 40°C, polymerization time was 16 hours.

Key:

a. Transformation rate

b. Percent regulator butyl used (by weight)

Table 1. Comparison of XLCR and X-100 Rubber Properties*

Property	XLCR	X-100 rubber
Tensile strength (kg/cm^2)	47-74	57
Extensibility (%)	404-582	398
Permanent strain (%)	16	7
Hardness (Shao-shi [6730 3044])	57	52
Shear strength (kg/cm^2)		
steel-steel	8.5-11	5.9-8.8
aluminum-aluminum	10.2-15	9.6

*Particulars (weight): raw rubber 100, 4-ethylene-5-amine 10, ZnO10, banbuqiang [0584 5943 1730] carbon black 10. Vulcanization conditions: 50°C x 48 hours.

Table 2. Comparison of Media Tolerance Performance of XLCR and X-100 Rubber

Item	XLCR	X-100 rubber
Heat resistance (100°C x 96 hours)		
Tensile strength (kg/cm^2)	38.4	79
Extensibility (%)	243	207
Hardness	58 (Shaoshi)	72 (JIS)
Oil resistance (30°C x 70 hrs, weight transformation rate, %)		
Gasoline	2.2	35
Reagent resistance (70°C x 70 hrs, weight transformation rate, %)		
50% H_2SO_4	1.98	3.8
5% HCl	28.7	18.7
50% NaOH	-2.58	-1.5
Saturated NaCl solution	-0.41	--
Water resistance (70 hrs, weight transformation rate, %)		
70°C water	23.1	11.2
30°C water	5.0	--
Heat resistance	self extinguishing	self extinguishing
Volume resistance (ohms meter)	10^8-10^9	10^8-10^9

4. The Ministry of Chemical Engineering's Institute of Marine Coatings used XLCR to improve neoprene chloride. The improved rubber's performance was better and improved the adhesion of the coating film; without a hardener it could be made into a self-hardening coating.

Conclusion

1. Use of photochemically synthesized XLCR has the features of being technologically simple, repeatable, and a pure product.

2. XLCR's physical and mechanical performance, such as tensile strength, extensibility, and shear strength come close to the similar Japanese product X-100 rubber.

3. The appropriate polymerization conditions for XLCR are: polymerization temperature of 40-50°C; polymerization time of 14-17 hours; quantity of regulator butyl used 8-12 percent.

4. Experiments prove that the monomer 2-chloro-1, 3-butadine and extraction isopropryl alcohol can be reused and this helps lower costs.

The following comrades also participated in this work: Wang Shulan [3769 3219 5695], Cao Guifang [2580 2710 5364], Li Qinghua [2621 3237 5478], Gao Lingmin [7559 3781 2404], Yang Huaqing [2799 5478 3830] and Yan Zhipei [7051 1807 0160].

[Acknowledgements] This work was supported by the Qingdao Chemical Industry Plant, the Ministry of Chemical Industry's Marine Coatings Institute, the Shandong University Department of Chemistry, the Shangdong Province Institute of Chemistry, the Shanghai Electric Cable Plant, the Shanghai Rubber Products Research Institute, the Shenyang Rubber No 4 Plant, the Qingdao Paint Plant, and the Tianjin Rubber Industry Research Institute and here we acknowledge our heartfelt gratitude.

References

1. The China University of Science and Technology, High Molecular Physics Laboratory, GAOJUWU DE JIEGOU YU XINGNENG [STRUCTURE AND PERFORMANCE OF HIGH POLYMERS], Kexue Chubanshe, 442 (1981).

2. Zhu Yongqun [2612 3057 5028], HECHENG XIANGJIAO GONGYE [SYNTHETIC RUBBER INDUSTRY], 4(1), 43 (1981).

3. Shanghai Electric Cable Plant, YETI LUDING XIANGJIAO JIEDUANXING YINGYONG XIAOJIE [LIQUID NEOPRENE STAGE APPLICATIONS CONCLUSIONS], Internal document, 1981.

8226
CSO: 4008/286

ANALYSIS OF 21 RADIATION INCIDENTS IN JINZHOU

Beijing ZHONGHUA FANGSHE YIXUE YU FANGHU ZAZHI [CHINESE JOURNAL OF RADIOLOGICAL MEDICINE AND PROTECTION] in Chinese No 1, 25 Feb 85 pp 46-47

[Article by Liu Xuecheng [0491 1331 2052], Wang Demin [3769 1795 3046] and Tang Tianwei [3282 1131 1218] from the Jinzhou Municipal Institute of Prevention and Treatment of Occupational Diseases]

[Text] Since the formulation and implementation of the regulations on radiation protection, the gradual stress on protection administrative work, the advancement of protective measures and the accumulation of work experiences, there have been very few or no occupational radiation injuries in the nuclear industry and the departments using radioactive elements. However, some radiation incidents have often happened. These incidents not only have caused great damage to the individuals' health and public property and have become an important cause of the irradiation of working personnel and residents but also have had profound political and psychological effects. Therefore, it is of great practical significance in the work of radiation protection to analyze the cause of the incidents, to sum up our experiences and the lessons learned, to research better safety administrative measures and to prevent and reduce the number of radiation incidents.

Classification and Analysis of Incidents

Since the 1960's, there have been 21 major and minor incidents in our municipality. With regard to the nature of the incidents (Table 1), most are external radiation incidents. Almost all of the lost and worn radiation sources were sealed gamma ray sources. In addition to accidental x-ray irradiation, external irradiation was 76.19 percent of the total incidents, while internal irradiation by radioactive contamination was only 23.81 percent.

Table 1. Classification of the Nature of Radiation Incidents

Nature of Incident	No. of Occurrences	Percentage
Missing worn (consumable) sources	12	57.14
Accidental x-ray irradiation	4	19.05
Radioactive Contamination	5	23.81

With regard to occupation in the occurrence of the incidents (Table 2), there were 17 incidents in geological prospecting, mechanical defect detection and medical service; this is 80.95 percent. The above three occupations should be our main target in accident prevention.

The causes of the incidents (Table 3) are mainly mismanagement, mishandling and faulty technical equipment. There were 15 incidents caused by mismanagement and mishandling, 71.43 percent of the total, which shows that irresponsibility is the primary cause of the incidents.

Table 2. Radiation Incidents According to Occupation

Occupation Related to Radiation Incidents	No. of Occurrences	Percentage
Geological prospecting	8	38.09
Machine defect inspection	6	28.57
Medicine	3	14.29
Metallurgy	1	4.76
Instruments	1	4.76
Electronics	1	4.76
Technical research units	1	4.76

Table 3. Causes of Radiation Incidents

Cause	No. of Occurrences	Percentage
Mismanagement	9	42.86
Mishandling	6	28.57
Malfunctioning technical equipment	6	28.57

Mismanagement is the main cause of missing radioactive sources. Radioactive sources used in defect detection were found missing mainly while in storage. Most of the cobalt was used for machine defect detection and long ago had been discarded and was not in use. It was usually stored in a place far away from humans. Since it was not watched by anyone, it was easily stolen, even though it was sealed and locked. Radioactive sources in the geological prospecting departments were found missing most often while they were in use. It is easy to lose them at the work site or during transportation. At well-prospecting or logging sites (such as during lunch time), the missing source was commonly taken away by children.

Another major cause of radioactive incidents is mishandling. In our municipality the three occurrences of accidental irradiation from x-ray machines for defect inspection and the one for medical treatment were all caused by negligence in following operational rules. This is especially true with radioactive contamination. A worker from some instrument factory used a spray gun to apply fluorescent powder which contained radium and this resulted in serious contamination of the work room and personnel. One research institute was overly anxious to dispose of some "waste" and concealed its mistake in dumping radioactive material, including radioactive sources, on a tailings dam. After being dumped, it was picked up by people at the place in question and caused contamination over a wide area.

The condition of technical equipment is also a factor which has resulted in radioactive incidents. At a radium plant, owing to the leakage of a settling trough, the radium solution leaked out and entered the heating system and caused the contamination of three boilers. In well prospecting or logging, radioactive probes were stuck in the drilling hole, resulting in loss of radioactive sources in the well; this caused a great loss of radioactive sources. It is an incident related to equipment worthy of our attention.

Consequences of the Incidents

The damage to personal health and property in the 21 radiation incidents which occurred in our municipality was serious. According to a rough estimate, 1 person suffered local irradiation as high as 1,000 roentgens which resulted in radioactive skin burns; 2 people suffered 25-50 rems of irradiation; 11 people suffered irradiation of 10-25 rems; and nearly 100 people suffered irradiation of less than 2.5 rems. Radioactive sources of 546.5 mCi, 50-100 kg of metallic uranium and 0.5 kg of thorium nitrate were lost; three sets of gamma ray defect inspection machines were found useless and one instrument painting and drawing room was left unusable. Moreover, it is difficult to estimate the human and material sources used to clean up the contaminated equipment in the room and administrative work needed to handle these incidents and the impact of these incidents on society and psychology; yet the loss is quite impressive.

Prevention of Incidents

It is very important to take vigorous measures to prevent or minimize radiation incidents to protect the health of the residents and working personnel and to prevent or minimize damage to state property. According to the situation of our municipality, our major attention should be focused on the three categories of geological prospecting, machine defect inspection and medical treatment. The major cause of these incidents is irresponsibility; administrative work needs to be stressed, ideological education of the personnel should be strengthened and knowledge about protection should be popularized to acquire a better understanding about radioactive protection. The geological prospecting departments should stress their protective management in the use, transfer and storage of radioactive sources. Especially while not in use, radioactive sources must be watched, and the vehicle used for transporting them should be

equipped with fixed containers for the radioactive sources and reliable locks for the doors of the vehicle. Storage houses for gamma ray sources used in machine defect detection should not be located too far away from humans where it is not convenient to guard them, and waste sources should be returned to the original plant for recovery. If it cannot be recovered, every province or municipality should still establish collective waste storage places to be guarded collectively. In x-ray detection, operation procedures must be strictly observed and personnel should never be allowed to be negligent or careless in order to prevent accidental irradiation. The lack of a warning signal on the head of currently used x-ray defect detection machines should be improved. We should also pay attention to equipment. All equipment used with radioactive material should undergo a strict quality control inspection in advance to prevent leakage. Equipment used for well prospecting or logging should be further improved to prevent incidents of radioactive sources being stuck in the bore.

FOOTNOTES

1. Fan Shengen [5400 3234 2704], Fushe Fanghu Tonxun [Reports on Radiation Protection], 1982 (3) p 12.

2. Wang Deming [3076 1795 2494], et al., translation from ICRP Publication No 12, Beijing, Yuanzineng Press, 1976.

3. Liu Zenghai [0491 1073 7845], et al., translation from ICRP Publication No 28, Beijing, Yuanzineng Press, 1982.

12909
CSO: 4008/303

ENDEMIC CHRONIC ARSENISM IN XINJIANG

Beijing CHINESE MEDICAL JOURNAL in English No 3, Mar 85 pp 219-222

[Article by Huang Yuezhen*, Qian Xuchun*, Wang Guoquan**, Xiao Biyu**, Ren Dunding***, Feng Zhaoyue****, Wu Jiyao**, Xu Rongjiang***** and Zhang Fenge*]

[Text]

This paper reports an investigation of endemic chronic arsenism due to drinking deep artesian well water in a plant in Kuitun Area, Xinjiang Uighur Autonomous Region. The 0.6 mg L arsenic concentration of this water was 15 times the maximal permissible concentration. In the plant, endemic chronic arsenism morbidity rate was 44.6%. The clinical features and histopathologic changes of this disease are described. The authors believe that areas of hyperpigmentation mixed with whitish depigmented spots are typical arsenic dyspigmentation, and that the spotted keratosis and corn-like keratosis palmaris et plantaris are typical arsenic keratosis although there are no standardly recognized specific diagnostic pathologic changes. These characteristic changes may aid in diagnosis.

Since 1980,[1] patients with chronic arsenism have been found in a certain area of Xinjiang Uighur Autonomous Region, northwest China. They had been drinking water from 270-meter-deep artesian well in the Oil Extracting Plant. We examined all residents of this plant in 1982. The results follow.

* Department of Dermatology, First Affiliated Hospital, Xinjiang Medical College

** Environmental Hygiene Teaching and Researching Section, Xinjiang Medical College

*** Chepaizi Hospital

**** Kuitun Anti-epidemic Station, Xinjiang

***** Physician in Advanced Training

WATER SOURCE

Until 1969, the residents of this plant drank river water and water from shallow wells. Since then, artesian well water was provided to the entire population in the area. Patients with dental fluorosis and osteofluorosis were found as early as 1980. Patients with chronic arsenism were also found then. The deep well water was found to contain fluorine 3.45 mg/L and arsenic 0.6 mg/L (standard permissible arsenic drinking water concentration is below 0.04 mg/L in China). There was no other source of arsenic contamination.

CLINICAL DATA

Disease incidence. The plant had 359 persons and 336 (93.6%) were examined including 135 workers, 128 pupils, 21 staff and 52 family members. All except 2 Hui nationality patients were Han nationality. The male to female ratio was 1:1.1 (160/176). 150 patients with skin lesions of chronic arsenism were found, a 44.6% morbidity rate. Morbidity is much higher in males than in females ($X^2=52.13$, $p<0.01$)

The majority of the 93 patients were over 30 years of age, forming 67% of all patients ($X^2=52.13$, $p<0.01$). The youngest was 7 years old and the oldest 74.

Incubation period. The shortest incubation

period was half a year and the longest 12 years. Because no other symptoms presented with the cutaneous lesions, most patients failed to remember the exact date of morbidity onset. Generally dyspigmentation appeared first, followed by keratoderma. According to the data of 97 patients, 72 started with dyspigmentation of the trunk with only 25 starting with keratosis on the palms and soles.

Clinical analysis. *General symptoms.* Subjective symptoms were usually mild. Patients with obvious palmoplanter keratosis may have pain especially during walking and working. 33 of the 150 were questioned thoroughly. General symptoms included abdominal pain 4, headache 7, amnesia 8, palpitations 10, insomnia 11, dizziness 12, numbness 13, fatigue 14 and thirst 31. Thirst was overwhelmingly the commonest symptom. Patients drank more than 2 liters of water daily, the highest intake was 8 liters daily. Paroxsymal numbness of the hands and feet was the commonest type of numbness. Biologic reflexes all existed but some were blunt and 3 cases were diagnosed as having peripheral neuritis previously.

Cutaneous lesions. The major lesions were dyspigmentation and keratosis. 126 had dyspigmentation usually confined to the trunk and extremities, rarely on the exposed parts of the body such as the face, hands and feet. Widespread lesions may invade the mucous membrane. On the basis of the degree of lesion extent, they may be divided into 3 grades: a. Mild in 83, the lesions were diffuse brownish pigmented macules and spots mixed with depigmented areas. These were regarded as early lesions. b. Moderate in 38, the lesions were brown macules mixed with whitish depigmented macules and mesh-like crisscrosses spreading widely over the thorax, abdomen, back and buttocks. This is called "piebald belly" by the locals. c. Severe in 5, the size and number of depigmented macules mixed with dark brown pigmented macules were numerous and looked like atrophy, simulating poikiloderma.

Keratotic lesions were found in 84, beginning chiefly on the palms and soles. They spread over the dorsal sides of the hands and feet, trunk and exposed limb sites. They may be divided into two forms clinically: Spotted keratosis occurred in 59 presenting as spotted hollows resembling spotted keratosis on the palms and soles. They became more apparent after being immersed in warm water. Corn-like keratosis was the typical chronic arsenic keratosis lesion in 24. The lesions spread widely and symmetrically on the hands and feet in corn-like projections with the centers slightly depressed. They often fused together forming plaques. Sometimes verruciformis keratosis, cutaneous corn-like keratosis, keratotic patches or papulae, porokeratosis-like, verruca senilis-like, folliculitis-like and telangiectasis-like lesions may be seen. In severe cases, keratotic patches or papulae accompanied by telangiectasis occur on the face. Multiple types of keratotic lesions may be seen in the same patient, especially severe cases.

Laboratory examinations. Blood routine, platelet count, liver function and SGPT test were all normal in 10.

Roentgenoscopic examinations. These were done in 10, 3 showed pulmonary tuberculosis and 1 peribronchitis.

Histopathologic changes. 15 skin biopsies from 12 cases, 6 from pigmented lesions and 9 from keratotic lesions were collected. Pigmented lesion showed histopathologic changes including irregular hyperpigmentation within the epidermis often accompanied by incontinence pigment and hypertrophy or hypotrophy in the prickle cell

layer. One corn-like keratotic lesion on the foot showed hyperkeratosis accompanied by columnar focal porokeratosis. Papillomatosis was seen in the epidermis and slight dermal inflammatory cell infiltration. Most keratotic patches (or papulae) on the trunk showed mild hyperkeratosis, irregular acanthosis, hypertrophy and hypotrophy. Dell-like hollows appeared in the hypertrophic epidermal layer with no relationship to the follicular or sweat duct orifices. Varying degrees of atypia occurred in some epidermal cells which were irregularly shaped and varied size, with deeply staining nuclei, mitosis and vacuolization. Dyskeratic cells were seen, similar to kerasenilis.

DISCUSSION

The morbidity of endemic chronic arsenism was 44.6% at the Oil Extracting Plant in Xinjiang. A similar report from Taiwan in 1968 reported endemic chronic arsenism caused by high arsenic content drinking water (0.8-2.5 mg/L), drunk for more than 45 years.[3] It showed similar cutaneous features but low 18.54% morbidity and high 1.05% skin cancer rate. Though skin cancer was not found in this series, precancerous lesions (e.g. arsenic keratosis, especially keratosis senilis) were demonstrated in histopathologic sections and 2 cases of cutaneous carcinomas, 1 squamous carcinoma accompanied by Bowen's disease and the other basal cell carcinoma were reported by Qian and his colleagues[2] in the same area. It was presumed that if wide scale examinations were conducted, more cutaneous carcinoma would have been found. The reason for the high morbidity needs further investigation. It is assumed that the concomitant high water fluoride content contributed to the effects.

All 150 patients had histories of long-term well water imbibing, the shortest period being 6 months and the longest 12 years. Usually dyspigmentation appeared without prominent subjective symptoms at disease onset, followed by keratotic lesions. Both types of lesions were found in 80 cases. Based upon the data, we suggest the following major indices for diagnosis: drinking high arsenic content water for long periods, at least more than half a year; cutaneous dyspigmentation of the trunk, brown pigmented spots mixed with whitish spots; multiple and symmetric spotted and corn-like keratosis. If one gets more than two major indices (the first is a necessary index), the clinical diagnosis of endemic chronic arsenism can be made. If the following subordinate indices are also present, the diagnosis is reinforced: peripheral neuritis; multiple cutaneous carcinomata; arsenic keratotic histopathologic changes; and high arsenic content in the urine, hair and nails. Histopathologic examinations of 12 cases showed that arsenic keratosis was accompanied by atypia and dell formation, characteristic of arsenic keratosis.

During this study prevention and treatment were carried out. Using water with lower arsenic content such as rain water or shallow well water in accordance with local conditions and treating the contaminated well water with basic aluminum chloride or alum precipitation 1 gm each alum and alkali to a liter of contaminated water, or 0.5 gm basic aluminum chloride and 1 gm alkali in 1 liter of contaminated water could effectively reduce the arsenic content from 0.6 mg/L to 0.03 mg/L after 24 hours. Most residents had no unfavorable reactions to the treated water. A few had mild stomach-aches at the beginning which soon disappeared.

Therapeutic measures were only necessary for patients with severe symptoms. These include:

Discontinuing drinking contaminated water. Distinctly lessens dyspigmentation and some normalized after one year. Palmar and plantar keratosis disappeared slowly. The speed of keratosis had been slow in most cases. In a few, the

keratotic lesions continued to develop despite discontinuance of contaminated water intake. It is possible that the arsenic stored in the body plays a role in the pathogenesis.

Detoxification. Dimercaprol (BAL) may be used in the initial stage. It forms complexes with arsenic and is prevented from entering the body. Natrium thiosulphate and high dose of vitamin C may be used intravenously.

Local therapeutic measures. 15% urea paste and 5-FU solution or 5% 5-FU cream may be applied to the keratotic lesions on the trunk, palms and feet twice daily. 5-FU solution therapeutic effects seem to be better.

REFERENCES

1. The Xinjiang office of the joint investigation group on fluorine poisoning; Report on Fluorine Poisoning in Kuitun Prefecture, Xinjiang. Prevention and Treatment Research News 1982; Vol 1, p 17.

2. Qian Xuchen [6929 2049 2504], Huang Yuezhen [7806 2588 3791], et al.: Skin manifestations of endemic chronic arsenism (Appended to an analysis of 270 clinical pathological cases). Unpublished.

3. Yeh S., et al: Arsenical cancer of skin. Cancer 1968; 21:312.

CSO: 4010/144

SWEDISH BIOTECHNOLOGY, MEDICINALS VENTURES--Pharmacia has written a so-called letter of intent with China's pharmaceutical administration. The agreement is to lead to deepened cooperation within both the biotechnology group and that of pharmaceuticals and diagnostics. In the long run, Pharmacia sees itself transferring both research and manufacturing to China. "I am very optimistic concerning the future development," said Erik Danielsson, managing director and office head of Pharmacia. Pharmacia AB Bioteknik has moreover entered into a special agreement with the Shanghai Institute of Pharmaceutical Industry for technical and commercial cooperation. This agreement may result in products produced by Pharmacia reaching out onto the world market. [Text] [Stockholm SVENSKA DAGBLDET in Swedish 30 Apr 85 p 21]

CSO: 3650/239-P

ENVIRONMENTAL QUALITY

HANGZHOU MAKES PROGRESS IN FIGHTING POLLUTION

OW170349 Beijing XINHUA in English 0250 GMT 17 May 85

[Text] Hangzhou, May 17 (XINHUA)--The environment around Hangzhou's picturesque West Lake has greatly improved over the past six years, Wang Bangduo, deputy mayor in charge of construction, said here today.

Smoke clouds have gone, and the water is clearer.

In 1984, 17 factories emitting black smoke were moved away, and stoves were renovated or fitted with dust removers.

Lake zone residents get preference in buying petroleum gas tanks.

It is planned to eliminate black smoke from the whole city by 1987, Wang said.

The following recent measures have improved the water:

--dredging 30,000 to 60,000 cubic meters of silt from the lake yearly;

--substituting hand- or battery-powered boats for diesels;

--lining 30 kilometers of dyke with stone;

--laying 15 kilometers of sewage trunk line to take waste water out to Hangzhou Bay; and

--letting 20 million cubic meters of river water into the lake.

The city is undertaking a project to divert 300,000 cubic meters of water daily from the Qiantang River to the lake. When it is completed at the end of this year, the lake water will be able to be changed monthly.

In the six years, the state has also invested 22 million yuan to build or repair scenic spots and parks.

The city has planted 336 hectares of parks.

The State Council wants Hangzhou to develop into a southeast China tourist center and one of the world's best scenic and tourist cities.

CSO: 4010/146

ENVIRONMENTAL QUALITY

AIRBORNE DUST POLLUTION RESEARCH URGED

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 1, 25 Jan 85 pp 10-12

[Article by Cao Yueqing 2580 1878 0615]: "Some Views on Developing Airborne Dust Pollution Research in China"]

[Text] With all our surveys and research in environmental quality since the early 1970's, we now have a basic understanding of the nation's atmospheric pollution situation. But how do we really assess this situation? What is an effective approach to pollution prevention? To what extent, and how, can we control air quality in the year 2,000? All these questions must be answered. And our ability to answer them objectively and accurately is inseparable from how much we know about China's atmospheric environment background. Yet at this point our data and research in this area are almost nil. In order to answer the basic questions above and ensure clean air for the people, we face an urgent need to include environmental research as a key item in the nation's "Seventh 5-Year Plan." This article offers some views on dust research, the leading atmospheric pollutant.

I. The Significance of Airborne Dust Pollution Research

1. To provide a scientific basis for the effective prevention and treatment, economic management and pollution evaluation of airborne dust* pollution, which is serious and must be tackled soon.

Years of environmental monitoring make it clear that air pollution is a serious problem in China. In 1979, 22 cities suffered from serious air pollution. And in all of them, including Guiyang where carbon dioxide pollution was worse than anywhere else in the country, dust was the No 1 atmospheric pollutant. Measures taken since mide-1970's to eliminate smoke and dust have brought dust pollution under partial control. (In Tianjin, fly ash concentration from 1975 through 1980 dropped 5-10 percent each year.) By and large, however, dust pollution is still a major hazard nationwide. Up to 1981, annual and daily fly ash concentrations in 10 key cities still

---

*In this article, dust includes both dustfall and fly ash. Dust which does not result from human activities but exists naturally in the atmosphere is referred to as natural dust or background dust.

exceeded the existing daily standards. In 1980, urban Beijing had more dustfall on an average day (0.86 g/sq.m) than the permitted amount for heavily industrialized areas overseas (0.85 g/sq, m). Even relatively unpolluted areas in Beijing recorded a monthly dust concentration which was three times higher than the permitted value in foreign regenerated land (2.5T/sq. km.) or that in London (2.12T/sq. km.) in 1977. If we are to bring dustfall and dust concentration down to existing health standards, we must in most cases reduce dust pollution by 1 to 10 times, compared to 1981. Most other nations have made dust pollution control and prevention a priority in their fight against and came to grips with it in the 1970's. Even Japan, which used to have the worst pollution record in the world, managed to bring it under control by the middle of the last decade. There is little doubt, therefore, that airborne dust pollution control should be the first item in our national pollution control and prevention agenda in the 1980's and 1990's.

Airborne dust pollution is at a fairly high level in China, as clearly demonstrated by the following facts: (1) In some areas (eg., Beijing), airborne dustfall even surpasses the amount of smoke and dust emitted. (2) Changes in the amount of dustfall are related to changes in wind-borne sand rather than smoke and dust emissions. (3) In some areas, as much as 50 percent of dust is made up of crust matter, with the local dust (that is, natural dust) accounting for 25 to 60 percent. In a dust storm, wind-borne sand, dust and soil can increase to as much as 80 to 90 percent. (One example is the Beijing area.)

In light of the above, the goals of dust pollution prevention, if they are to have any real meaning at all, must be premised on the elimination of background dust pollution. Otherwise, some regions (especially those in north China) will never be able to overcome the problem of dust pollution. China's current dust environmental standards (both health-based standards and emission standards) are mostly based on foreign experiences. They should be revised to take into account this country's background dust situation. The evaluation of atmospheric environmental quality, too, should incorporate into it the background dust issue. Moreover, dust pollution prevention and treatment should include the reduction of background dust (natural dust).

China must not delay the launching of airborne dust environmental background research in order to provide a scientific basis for the prevention and treatment of dust pollution, the formulation of an environmental management policy (including the settling of standards) and a more accurate evalution of environmental quality.

2. The need for environmental districting in China

Among the numerous sources of natural dust, the three major ones are vegetation dust, wind-borne sand, dust and soil and sea salt particles, each of them making up at least 20 percent of the earth's total atmospheric basic aerosol. China's climate, geography and geology are such that they provide the right conditions for producing and transporting these matters. Hence the high probability that they may exist in airborne natural dust (particularly wind-borne sand, dust and soil). But since their distributions and concentrations

in natural dust vary from place to place and from season to season, we must conduct nation-wide unified observations, go in for systematic research and try to district the nation according to the distribution of air-borne background dust. As natural dust is one of China's distinct environmental factors, which cannot be ignored, districting by dust distribution should be an indispensable part of the country's environmental districting. China is a vast country in which environmental conditions differ from region to region. With environmental districting, a locality can draw up its own environmental policy in accordance with its environmental features.

3. The case for global environmental research

Airborne dust has a global existence. (Its minute particles can stay in the atmosphere for an extended period of time.) It affects not only the physical and chemical properties of the atmosphere, or the quality of the very air which sustains human existence, but also global climatic changes (there are theories suggesting that dust either warms up the earth or cools it down), even the long-term evolution of our geology. As the climate changes and desertification intensifies around the world (it is advancing at an annual rate of 1,800 sq. km. in China), we are becoming more and more concerned about airborne dust, especially natural dust in deserts. China is a major source of airborne dust and soil in the world. What originates in this country may affect the North Pole and exercise a key impact on the global atmosphere (especially in the mid-latitude region). Hence the rising attention to this problem among environmentalists all over the world in recent years. We should try to bring credit to the nation and contribute to global environmental research by doing what we should about this distinctly Chinese environmental problem--natural dust in wind-borne sand.

4. The promotion of multidisciplinary research

Since natural dust occurs in the interface of the various environmental media (soil--air, water--air), its research involves a large area and is a highly complex field. By focusing on it, we may promote our nation's environmental research in depth as well as in breadth and advance the development of geochemistry, atmospheric sciences, Quaternary period geology and so on.

5. By the year 2,000 there will have been substantial increases in our national total industrial and agricultural output value and population. Accordingly, we should launch a research program on natural airborne dust as soon as possible so that we can build up the relevant data and lay the foundation for the evaluation of changes in the atmospheric environment and its quality.

6. Dust volume measurement is a relatively easy task in air pollution monitoring. Research in background dust may pave the way for the establishment of a national atmospheric environmental background monitoring network and our participation in the worldwide atmospheric pollution background monitoring system.

II. Domestic and International Research Trends and Our Chances of Success in Dust Environmental Background Research

Foreigners have been paying a good deal of attention to, and been active in, the environmental background research of airborne dust, conducting studies at the South Pole, in high altitudes and above the oceans. Since the 1970's, they have also combined their research in this area with dust storm research. The United States regularly collects dust samples on an island in the Pacific Ocean to study dust originating from Asia. Testing methods have achieved a high degress of continuity and automation. Laser radar, for instance, can directly determine the composition and condition of dust in the atmosphere. In the global atmospheric background monitoring network, the amount and composition of fly ash and dustfall are among the essential monitored items. It is hoped that we will be able to set up 19 atmospheric environmental background monitoring stations (regional stations).

In the past we had almost nothing in the way of atmospheric environmental background research. (Our only project was a study on the composition of the melted snow of Mt. Qomolangma.) The distribution of clean control points in most locations does not meet the requirements of background monitoring. But conditions do exist for our gradual entry into environmental background research beginning in 1986.

1. We have established a national environmental monitoring control center. A nationwide atmospheric environmental monitoring network is already in place.

2. As a result of the monitoring of and research on airborne dust since the early 1970's, we have developed a series of testing methods and trained a research contingent.

3. Our past study on the environmental background of Mt. Qomolangma and current research on the environmental background of water and soil will pave the way for the more complex field of atmospheric environmental background research.

With the appropriate amount of effort, therefore, the project is not an impossibility.

III. The Substance of Research

1. The simultaneous monitoring and sampling of dustfall, fly ash and atmospheric turbidity by the national atmospheric environmental background monitoring network.

2. The field observation and examination of atmospheric natural dust in the nation's representative atmospheric environmental background regions (the clean area of Mt. Qomolangma, for instance) and natural-dust originating regions (deserts, oceans).

3. Research on the physical and chemical properties of atmospheric natural dust.

4. The origins of China's atmospheric natural dust. (1) agents (the respective proportions of wind-borne sand, sea salt and vegetation particles; (2) originating locations (foreign and local).

5. The impact of wind-borne sand on atmospheric environmental background (natural dust) and its mechanism.

6. Environmental districting research on China's airborne natural dust.

7. Research to reduce China's airborne dust background value.

8. Research on the analysis and testing methods of dust particle, eg., the application of laser.

IV. Key Methods of Implementation

1. Large-scale multidisiplinary projects, perhaps involving agencies in environment, meteorology, health and the Chinese Academy of Sciences. Establishment of a leadership group and data group.

2. Establishment of a national atmospheric environmental background monitoring network equipped with highly sensitive, highly-precise, multi-informational and continuously automatic dust monitoring instruments. (The range of the particle monitor, for instance, should be from 0.3 to 100 microns) and meteorological observation equipment. Geographical distribution can be determined by consulting the site selection requirements of the international atmospheric pollution background monitoring station.

3. Since our present research and technical capability in this area is rather inadequate, the training of relevant experts is an urgent task which must be dealt with as soon as possible.

4. It is proposed that the investigation of and research on natural atmospheric environmental background be made a key environmental project in the "Seventh 5-Year Plan" period. (Preparatory work and local pilot projects can be carried out before 1986.)

12561
CSO: 4008/300

ENVIRONMENTAL QUALITY

CEMENT MILLS URGED TO USE MORE INDUSTRIAL WASTE

OW141219 Beijing XINHUA in English 0826 GMT 14 May 85

[Text] Beijing, May 14 (XINHUA)--China's cement makers are urged to make better use of industrial waste and reduce energy consumption in cement production.

"The use of industrial waste helps energy conservation, land preservation and environmental protection," said Wang Yanmou, deputy director of the China administration of the Building Materials Industry, at the "Beijing international symposium on cement and concrete" which opened here today.

In China, he said, 70 percent of blast furnace slag is used as blending material in making cement, but only 15 percent of coal gangue is used as raw material for roofs and walls.

China's first cement mill was set up in 1889, but the output in 1949 was only 660,000 tons.

China now has 57 large- and medium-sized cement mills and 4,800 small ones, which produced 123 million tons of cement in 1984, ranking No 2 in the world.

Wang said, "Work on more and more transport, energy and water conservancy projects will make cement and concrete the major building material for a long time to come. At the end of this century, China will need more than 250 million tons of cement a year."

The small cement mills produced nearly 94 million tons of cement last year, accounting for 76 percent of the country's total.

However, Wang said, they need to improve quality and lower production costs.

Sponsored by the Chinese Silicate Society, the four-day symposium, the first ever held in China, is attended by 219 experts from 12 countries and regions.

CSO: 4010/146

ENVIRONMENTAL QUALITY

YILUO RIVER WATER QUALITY MODEL, PREDICTION SYSTEM STUDIED

Dalian HUANJING KEXUE XUEBAO [ACTA SCIENTIAE CIRCUMSTANTIAE] in Chinese
No 4, Dec 84 pp 301-312

[Article by Guan Boren [7070 0130 0088] and Guo Huaicheng [6753 2037 2052], both of the Department of Geography, Beijing University; and Zhou Caijing [0719 2624 2417], Center for Environmental Science, Beijing University: "A Study of Water Quality Model and Prediction System for Yiluo River"]

[Summary] The water quality model and its prediction system presented in this paper are a part of the study of water quality assessment and management planning of the Yiluo River. Based upon specific hydrology of streams in China, mechanism variation in water quality and information of the water quality system collected from 1981 to 1983, model selection, parameter identification and dynamic models of water quality were made within different reaches of the Yiluo River. Taking into account the effects of the stochastic factor in natural streams on water quality here, the random error of the models was introduced to show the effects of stochastic factors on BOD-DO concentrations, and then a self-adaptive technique was used to rectify automatically stream state estimation and its prediction system and the Kalman filter technique was adopted to establish water quality state estimation and its prediction system. The results were considered to be satisfactory and successful. This was an attempt to recommend a mathematical calculating technique to improve and enhance the precision of water quality models. Research on applications of water quality models will certainly benefit from the system.

ENVIRONMENTAL QUALITY

BHC POLLUTION CONTROL STUDIED

Dalian HUANJING KEXUE XUEBAO [ACTA SCIENTIAE CIRCUMSTANTIAE] in Chinese
No 4, Dec 84 pp 325-332

[Article by Wang Chunsheng [3769 2504 3932], Luo Qingxiu [5012 3237 0208] and Lu Juanzi [7120 1227 1311], et al., all of Wuhan Institute of Virology, Chinese Academy of Sciences: "A Plasmid with Gene Coding for Benzene Hexachloride Degradation"]

[Summary] Benzene hexachloride (BHC) is a notorious insecticide recalcitrant in nature and hence renders serious environmental pollution after extensive application for years. To deal with this problem, a previous work by our institute found a strain of bacterium II_5-A which was able to degrade both β- and γ-BHC. This strain can utilize BHC as a sole carbon source under aerobic conditions. It is the finding of this paper that the strain II_5-A harbors a plasmid encoding the information of BHC degradation. An experiment was carried out as follows.

Results of a curing experiment with mitomycin C proved that the clones which were cured plasmid lost the growing ability in a medium of mineral salts with BHC as the sole carbon source. The curing ratio was 3-14.7 percent. It is suggested that the plasmid existing in II_5-A carries gene(s) relating to the degradation of BHC. The isolated plasmic was then transferred to Escherichia coli C600 and the transformants possessed the ability to degrade BHC successfully. The plasmid from the transformant was found to be the same as that from II_5-A in electrophoretic characterization.

All of the results produce evidence that the gene coding for BHC degradation is located on the plasmid, which is therefore called a BHC plasmid. This approach may help in controlling BHC pollution.

9717
CSO: 4009/109

ENVIRONMENTAL QUALITY

YILUO RIVER SUMMER OXYGEN BALANCE DESCRIBED

Beijing ZHONGGUO HUANJING KEXUE [ENVIRONMENTAL SCIENCES IN CHINA] in Chinese No 1, 21 Feb 85 p 30

[Article by Guan Boren [7070 0130 0088] and Guo Huaicheng [6753 2037 2052], both of the Department of Geography, Beijing University: "Features of the Oxygen Balance During the Low Water Summer Period in the Yiluo River"]

[Summary] The Yiluo River is the largest tributary in the lower reaches of the Yellow River. The lowest discharge and highest water temperature occur in the early summer (June to July), influenced by organic wastewater during this period. The following phenomena were observed in the lower reaches: (1) DO concentrations were high and sometimes increased with the increase of the BOD value; (2) DO concentrations were positively related to water temperature, and (3) there were obvious daily variations in DO. This was shown by observations to be due to algae blooms. According to these phenomena, the authors suggest that for such rivers: (1) much attention be paid to monitoring DO at night; (2) the lowest DO just before sunrise be used in water pollution control, and (3) BOD be employed as the main index for water quality evaluation of organically polluted rivers.

9717
CSO: 4009/175

ENVIRONMENTAL QUALITY

BRIEFS

HENAN ANTINOISE MEASURES--Zhengzhou, 7 May (XINHUA)--A computerized noise monitoring station has worked well since it went into operation in mid-April in Luoyang, Henan Province, according to the city's Environmental Protection Bureau today. Data recorded by the station showed that the noise in the downtown area has been reduced to below the state stipulated limit, an official of the bureau said. Luoyang attaches great importance to environmental protection and the authority keeps its 990,000 residents informed of the anti-pollution regulations once a year. Since last year, noise on the city's main streets has been reduced by an average of 6.82 decibels. Luoyang has 470 enterprises, and a citywide atmosphere monitoring system has been established over the past few years, the officials said. [Text] [Beijing XINHUA in English 0828 GMT 7 May 85 OW]

STUDY OF RIVER RESOURCES, POTENTIAL--The Ganjiang River, a major Yangtze River tributary that flows through Jiangxi Province, will play host to a team of scientists over the next two years. The scientists will survey the river's resources, water transport prospects, hydroelectric potential and aspects of flood control, irrigation and fish breeding. The survey was commissioned by the Chinese Academy of Sciences as part of an overall effort to upgrade the economy of the region. At the end of the two years' study, the survey team will synthesize its findings into two alternate proposals for development of the Ganjiang River area. The river basin covers about 120,000 square kilometers, about two-thirds of the total area of Jiangxi Province. [Text] [Beijing CHINA DAILY in English 11 May 85 p 2 HK]

PRC, JAPAN TO COOPERATE IN FIGHTING POLLUTION--Beijing, May 9 (XINHUA)--Chinese and Japanese environmental protection officials have agreed to co-operate closely in the battle against pollution, it was announced today. Qu Geping, director of China's Environmental Protection Agency, told reporters here that he had had two days of "extremely friendly" and "most fruitful" discussions with a visiting delegation of environment chiefs from Japan. It was learned that the Chinese and Japanese agencies had expressed the desire to exchange ideas on environmental protection strategies. They had also agreed that the Research Institute of Environmental Sciences of China and the Japanese Environmental Pollution Research Institute should co-operate and make regular exchanges of their work. The two sides planned to strengthen co-operation in publicity, education and environmental information, and to promote exchanges between cities and non-governmental organizations. The 18-member Japanese delegation, headed

by Yasuo Shoda, administrative vice minister of the Japanese Environmental Protection Agency, arrived in Beijing on Tuesday at the invitation of the Chinese agency. Members will be accompanied by Qu Geping on visits to Wuxi, Suzhou and Shanghai, before leaving for home on Sunday. [Text] [Beijing XINHUA in English 1930 GMT 9 May 85 OW]

CSO: 4010/146

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

YOUNG SCIENTISTS FORMING PRIVATE ENTERPRISE

Beijing GUANGMING RIBAO in Chinese 31 Jan 85 p 1

[Article by Zhang Yaguang [1728 0068 0342]: "A Group of Young Scientists and Technologists Sets Up Computer Company to Undertake Research Projects for the State on a Contract Basis"]

[Text] Recently, a group of young researchers of the Institute of Computing Technology and Institute of Automation of the Chinese Academy of Sciences (CAS), got together on their own and formed a scientific, industrial and commercial integrated body primarily for scientific research. This body was named the "Hope (Xiwang [1585 2598]) Advanced Computer Corporation (H Computer Corporation)." It has already collectively secured a state key project --an office business processing system--in the form of a compensatory contract.

Of the 24 "Xiwang" Corporation component members, 18 are graduates since 1981 and who hold master's degrees in various fields of computing technology and automation. Their average age is 33 years, with the youngest being 24 and the oldest just over 40. They were all operational backbones of their original units. Zhou Mingtao [0719 2494 7118], one of the initiators, for example, was a member of a key microcomputer project leading group of the Institute of Computing Technology. Hu Kangtong [5170 1660 6639] and seven others were team leaders with the Program Office. Although they were given weighty responsibilities, they deeply sensed the pitfalls of the current scientific and technological research system, which made it impossible for them and the broad masses of scientific and technological personnel to display their abilities to the fullest.

Since July of last year, Zhou Mingtao, Zhou Tongheng [0719 0681 5899] and others jointly wrote to the CAS leadership on three occasions, expressing their willingness to become reform pioneers and be released from the restraints of the current system in order to make still greater contributions to the state. To make their point, some of them voluntarily passed up opportunities to pursue further studies abroad, or opportunities to solve the problem of couples living in separate localities.

Their wishes were enthusiastically supported by Yan Dongsheng [0917 2639 3932], Secretary of leading Party group and Vice President of the CAS. Yan

instructed the first line leadership to study the issue, sign a contract with the group covering responsibilities, rights and profits, and proceed as an experimental unit. Vice President Zhou Guangzhao [0719 0342 0664], since returning from his trip abroad, has met with the group on two occasions, encouraging the group to unite with comrades of CAS, its institutes and other corporations in bringing the role of their specialties into play in order to develop "Hope" into a corporation like the "Apple" Company of international fame (The American "Apple" Company is a computer development company which was founded by two college students).

Reforms proposed by Zhou Mingtao and others were also well supported by the CAS Technical Science Department No 1 and the Institute of Computing Technology. The latter provided an 800,000-yuan loan and four microcomputers to the "Hope" Corporation. Although there was a space shortage, the Institute of Computing Technology vacated six of its rooms for the new company to use.

To date, the "Hope" Corporation has decided to primarily direct its technological development efforts toward office automation, software and hardware for various types of computers, applied management software, and computer peripheral design systems. The corporation is now open for business.

CSO: 4008/1026

Applied Mathematics

AUTHOR: SHEN Huichuan [3088 1920 1557]

ORG: China University of Science and Technology, Hefei

TITLE: "Fission Lines of Monochromatic Elastic Wave Spectrum"

SOURCE: Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 5, No 4 Jul 84 pp 541-551

ABSTRACT: Based on the analogy with quantum electrodynamics, the Dirac equation of elastic wave-phonons is derived and fission lines of a monochromatic elastic wave spectrum subjected to an external field are studied in this paper. The problem of fission is answered on theoretical grounds by referring to two examples based on the Dirac equation of elastic wave-phonon. Proving experimentally whether or not precision this high is attainable in quantum electrodynamics is a task of workers in experimental physics and mechanics. If one considers that there should not be much difference between material waves and other conventional waves, the theory arrived at through analogy with quantum electrodynamics should not pose any problem. Although the monochromatic elastic wave is the object of study, the principle is similarly applied to other analogous wave problems. The fission of monochromatic elastic wave spectrum was observed in free oscillations caused by the earth's rotation and oblateness as reported by F. D. Stacey in PHYSICS OF THE EARTH, published by John Wiley & Sons, Inc. in 1977. Some 70 mathematical equations are included in the paper, which was recommended by Qian Weichang [6929 0251 7022]. The paper was received for publication on 24 February 1983.

10424
CSO: 4009/116

Chemistry

AUTHOR: WU Jigui [0702 7162 6311]
DENG Ruwen [6772 3067 3306]
HE Xiaoling [0149 2556 3781]

ORG: None given

TITLE: "Study on the Rare Earth Compounds of Phthalylsulfathiazole"

SOURCE: Lanzhou LANZHOU DAXUE XUEBAO (ZIRAN KEXUE BAN) [JOURNAL OF LANZHOU UNIVERSITY (NATURAL SCIENCE EDITION)] in Chinese Vol 20, No 4, 28 Dec 84 pp 71-77

TEXT OF ENGLISH ABSTRACT: Sixteen rare earth chloride compounds of phthalylsulfathiazole sodium have been prepared in aqueous solution. Their solubilities, IR absorption spectra, TG curves, NMR spectra and electric conductance have been investigated. The compositions of the new compounds have been determined as $Ln_2(PST)_3 \cdot 6\ H_2O$, $Ce(PST)_2 \cdot 2\ H_2O$, (Ln = different rare earth ions, PST = ion of phthalylsulfathiazole). With the structure of the compounds discussed, it was pointed out that rare earth ions bond with carboxyl radical and sulfonamido group N of phthalylsulfathiazole anion in these compounds.

AUTHOR: WEN Ximeng [2429 1585 1322]

ORG: Institute of Atomic Energy, Chinese Academy of Sciences

TITLE: "Determination of Microamount Silicon in Sodium Metal"

SOURCE: Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 12, No 1, 20 Jan 84 pp 56-59

TEXT OF ENGLISH ABSTRACT: This report presents the device, the experimental technique and the results of the spectrophotometric determination of microamount silicon in sodium metal as silicomolybdate blue. The determinable range is 1-15 ppm. The silicon can be recovered quantitatively, if a 5 μg of silicon is added in one gram of sodium or so. The percentage recovery is 101.4 percent, and the relative standard deviation is 7.5 percent. The results of determinations of various samples (involved with solid and liquid sodium of industrial, chemical pure or high-pure grade) were obtained with satisfactory accuracy.

AUTHOR: XIAO Deming [5135 1795 2494]
GAN Xuanji [3927 3872 3875]
ZHANG Hongwen [1728 7703 2429]

ORG: Beijing Uranium Geology Research Institute

TITLE: "Determination of Uranium and Thorium in Geological Materials by X-Ray Fluorescence Spectrometry"

SOURCE: Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 11, No 10, 20 Oct 83 pp 750-753

TEXT OF ENGLISH ABSTRACT: A direct determination of uranium and thorium in ores and rocks for various matrix by XRF is described. The concentration range detectable for both U and Th in this method covers over from 0.0001 to 0.1 percent. Accuracy and precision of the method are comparable to those of the wet chemical analysis. The matrix effect in XRF is corrected by the peak-to-background ratio method. The lower limits of detection (200 sec) for uranium and thorium are 1.04 ppm and 0.93 ppm respectively. Total counting time is 6 to 7 minutes.

AUTHOR: ZUO Zhengyi [1563 2182 5030]
GUAN Qun [7070 5028]
LIAO Yiping [1675 0001 1627]
ZHANG Misha [1728 4717 5446]
ZHU Kaixuan [2612 0418 2467]
LI Anmo [2621 1344 2875]

ORG: Zuo, Guan of Aviation Fuel and Oil Research Institute, Air Force; Liao, Zhang, Zhu, Li of Department of Chemistry, Beijing University

TITLE: "Direct Determination of Wear Metals Copper and Iron in Lubricating Oils by Flame Atomic Absorption Spectrometry"

SOURCE: Changchun FENXI HUAXUE [ANALYTICAL CHEMISTRY] in Chinese Vol 11, No 10, 20 Oct 83 pp 754-756

TEXT OF ENGLISH ABSTRACT: A procedure is described for the determination of copper and iron in used lubricating oils (domestic) after dilution with mixed solvent (methyl isobutyl ketone, alcohol and hydrochloric acid). Standards are prepared from pure metals, unused lubricating oil and mixed solvent. The method is rapid, simple and has been used successfully for the determination of 0.1 to 20 ppm of copper and iron in various oils.

CSO: 4009/1011

AUTHOR: YIN Jinghua [3009 2417 5478]
LI Bincai [2621 2430 2088]

ORG: Both of Changchun Institute of Applied Chemistry, Chinese Academy of Sciences

TITLE: "[η]-M Relationship and Unperturbed Dimension of cis-1,4-Polybutadiene in Various Solvents"

SOURCE: Beijing GAOFENZI TONGXUN [POLYMER COMMUNICATIONS] in Chinese No 3, Jun 84 pp 187-191

TEXT OF ENGLISH ABSTRACT: [η]-M relationships for cis-1,4-polybutadiene in tetrahydrofuran, methyl cyclohexane, n-heptane and a mixture of butanone and n-heptane (2:1, volume) at 30°C were determined and were found as follows: $[\eta]_{THF}^{30°C} = 0.0246\bar{M}_W^{0.732}$; $[\eta]_{\text{methyl cyclohexane}}^{30°C} = 0.0293\bar{M}_W^{0.698}$; $[\eta]_{\text{n-heptane}}^{30°C} = 0.1181\bar{M}_W^{0.547}$; $[\eta]_{\text{butanone, n-heptane}}^{30°C} = 0.1800\bar{M}_W^{0.500}$.

$\bar{M}_W$ was measured by the light scattering method. The mixed solvent at the given temperature was found to be a θ solvent. The unperturbed dimension ($<\gamma_0^2\ ^{1/2}/M^{1/2}$) of cis-1,4-polybutadiene was estimated with KS, SF and IP equations to be 0.0901 nm, 0.0928 nm and 0.0915 nm respectively, and the value obtained at θ condition is 0.0896 nm.

AUTHOR: ZHU Xinghao [2612 5887 3185]
et al.

ORG: Jilin Chemical Industry Corporation Research Institute

TITLE: "Dilatometric Studies of the Polymerization of Isoprene by Lanthanide Catalyst"

SOURCE: Beijing GAOFENZI TONGXUN [POLYMER COMMUNICATIONS] in Chinese No 3, Jun 84 pp 207-213

TEXT OF ENGLISH ABSTRACT: The kinetics of the polymerization of isoprene in hexane in the presence of Ln naphthenate-$Al(i\text{-}Bu)_3$-$Al_2Et_3Cl_3$ catalyst were studied in a specially designed dilatometer. The polymerization showed to be first-order in monomer and 1.75th-order in catalyst. In a typical polymerization, the concentration of the propagating chain has been calculated to be 3×10^{-6} mol/l. Therefore, the efficiency of lanthanide catalyst is 2.8 percent and the rate constant of absolute propagations is 41 l/mol/sec (50°C).

9717
CSO: 4009/182

AUTHOR: HE Binglin [0149 3521 2651]
YU Yanseng [0060 3601 3932]
QIAN Tingbao [6929 1656 1405]
et al.

ORG: All of the Department of Chemistry, Nankai University

TITLE: "Investigation of a New Type of Adsorbent--Spherical Carbonized Adsorbent III"

SOURCE: Beijing GAOFENZI TONGXUN [POLYMER COMMUNICATIONS] in Chinese No 4, Aug 84 pp 283-287

TEXT OF ENGLISH ABSTRACT: Polyvinylidene chloride beads were first heated at 185°C and then pyrolyzed at 960°C under a nitrogen atmosphere in a cracking furnace. The surface area of the spherical carbonaceous adsorbent exceeds 1000 M^2/g, and its capacity for adsorbing creatinine is over 99 percent. The mechanical strength of the spherical carbonaceous adsorbent of 0.6-0.8 mm in diameter is quite good.

AUTHOR: DENG Zhuo [6772 0587]
ZHANG Yan [1728 3601]
DING Youjun [0002 2589 7486]
et al.

ORG: All of the Department of Chemistry, Beijing University

TITLE: "Structure of Polysulphone-Nylon 6 Block Copolymer Film"

SOURCE: Beijing GAOFENZI TONGXUN [POLYMER COMMUNICATIONS] in Chinese No 4, Aug 84 pp 288-291

TEXT OF ENGLISH ABSTRACT: The structure of polysulphone-nylon 6 block copolymer film was studied by inverse GC, electron microscope and polarizing microscope. The heat of adsorption of water on the surface of this block copolymer was determined by IGC. Experimental results show that the crystallinity of nylon 6 is decreased by the addition of polysulphone component, and the copolymer formed is composed of nylon 6 crystal domains and amorphous domains comprising both nylon 6 segments and polysulphone segments. IGC results also show that the compatibility of the two components is relatively poor.

AUTHOR: WANG Songbo [3769 2646 3134]
SONG Hong [1345 1347]
YOU Yiping [1429 0001 1627]
TANG Xueming [0781 1331 2494]

ORG: All of the Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun

TITLE: "Reducibility of Alkylaluminums and the Active Valence State of Molybdenum"

SOURCE: Beijing GAOFENZI TONGXUN [POLYMER COMMUNICATIONS] in Chinese No 4, Aug 84 pp 292-295

TEXT OF ENGLISH ABSTRACT: The effect of various aluminum alkoxides in match with the same molybdenum alkoxide on the activity in the polymerization of butadiene has been studied. The order of activity of R_2AlOR' with varied R is as follows:

$(i\text{-}Bu)_2AlOPh > Et_2AlOPh \gg Me_2AlOPh$, when R' = Ph;

$(i\text{-}Bu)_2AlOC_8H_{17} > Et_2AlOC_8H_{17}$, when $R' = C_8H_{17}$.

The order of activity of R_2AlOR' with varied R' is as follows:

$(i\text{-}Bu)_2AlOPh > (i\text{-}Bu)_2AlOC_8H_{17}$, when R = i-Bu;

$Et_2AlOPh > Et_2AlOC_8H_{17}$, when R = Et.

The active valence state of molybdenum as determined by ESR is three.

AUTHOR: WANG Heting [3769 0735 0080]
ZHANG Shuying [1728 3219 5391]
MAO Zulin [3029 4371 2651]
et al.

ORG: All of the Institute of Chemistry, Chinese Academy of Sciences

TITLE: "Oxidative Thermal Stability of Some Model Compounds with Heterocyclic Rings"

SOURCE: Beijing GAOFENZI TONGXUN [POLYMER COMMUNICATIONS] in Chinese No 4, Aug 84 pp 300-304

TEXT OF ENGLISH ABSTRACT: The oxidative thermal stability of two series of 13 model compounds I-XIII containing benzothiazole, benzoxazole, benzimidozole, phthalimide, benzoxazinone and quinoxaline ring was measured. The results indicate that the order of oxidative thermal stability of these two series of model compounds are I > II, VII, IV, VI > III > V and VIII > IX > XI > XIII, XII > X, respectively. A compound with the benzothiazole ring possesses the best oxidative thermal stability, and the next is that with a benzoxazole ring, then that with a phthalimide ring. The oxidative thermal stability of compounds with the other three heterocyclic rings is not as good.

AUTHOR: DING Youjun [0002 2589 7486]
LIN Xia [2651 7209]
DENG Zhuo [6772 0587]

ORG: All of the Department of Chemistry, Beijing University

TITLE: "Studies of the Properties of Solution of Polysulfone-Nylon 6 Block Copolymers and Its Compatibilities with Polysulfone and Nylon 6 Homopolymers"

SOURCE: Beijing GAOFENZI TONGXUN [POLYMER COMMUNICATIONS] in Chinese No 4, Aug 84 pp 313-317

TEXT OF ENGLISH ABSTRACT: The compatabilities of polysulfone (B)-nylon 6 (N) block copolymers with the blend of homopolysulfone and homonylon 6 and the properties of the block copolymers and their blends in various solvents were studied.

The phenomenon that different viscosities and molecular conformations occurred when the copolymers were dissolved in O-chlorophenol and formic acid was observed. The B-N (or N-B-N) block copolymers can play the role of emulsifier in these solvent pairs: formic acid-chloroform, formic acid-chlorobenzene and formic acid-dichloromethane. Stabilities of these emulsions depend on the composition of copolymers (as emulsifiers) and the ratios of volume of these solvent pairs in each system. The presence of two phases in the B-N (or N-B-N) block copolymers was characterized by PM and SEM. The results show that B-N (or N-B-N) block copolymers can be compatible agents for polymer-polymer systems and solvent-solvent systems.

AUTHOR: WANG Dianxun [3769 3013 8113]
LI Yongjun [2621 3057 6511]
JIANG Yingyan [3068 5391 1750]

ORG: All of the Institute of Chemistry, Chinese Academy of Sciences

TITLE: "Structural Study of Poly-γ-Mercaptopropylsiloxane-Carbonylrhodium Catalyst by X-ray Photoelectron Spectroscopy"

SOURCE: Beijing GAOFENZI TONGXUN [POLYMER COMMUNICATIONS] in Chinese No 4, Aug 84 pp 318-320

TEXT OF ENGLISH ABSTRACT: The structure of poly-γ-mercaptopropylsiloxane-carbonylrhodium catalyst has been investigated by X-ray photoelectron spectroscopy (XPS).

The experimental results indicate that the catalyst is formed by substituting two bridged chlorine atoms in tetracarbonyl-μ-dichlorodirhodium molecule with two sulfur atoms in silica-supported poly-γ-mercaptopropylsiloxane. Thus, the structural formula for the catalyst can be derived.

9717
CSO: 4009/183

AUTHOR: DU Qishi [2629 1142 4258]
PENG Zhouren [1756 0719 0086]

ORG: Both of the Department of Chemistry, Lanzhou University

TITLE: "The ab initio Calculation of the Hellmann-Feynman Force and Its Applications in the Study of the Chemical Bond. I. Theory and Calculation"

SOURCE: Shanghai HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese No 9, Sep 84 pp 843-849

TEXT OF ENGLISH ABSTRACT: In the present investigation the theory and formulae for the ab initio calculation of the Hellmann-Feynman force are presented, and the FORTRAN IV general program ABHF is made. Based on the works of others and the LCAO-MO theory, the formulae for analysis of the electronic force are proposed. The calculations of the H-F force obtained from the polycentral GTO basis set, which is presented here, and from the program ABHF are better than those obtained from the basis sets 4-31G and 6-31G, or from Clementi's wave function of the molecule HF(16STO). The net force acting on the nucleus F is 0.022575 a.u., and that on the nucleus H is -0.057023 a.u. in our calculations. The results of the calculations of the energy, dipole moment and virial value are improved.

AUTHOR: ZOU Youzhong [6760 0645 1813]
TANG Zongxun [0781 1350 5651]
CHEN Yunsheng [7115 6663 3932]

ORG: ZOU of Northwestern Architectural Engineering College, Xi'an; TANG of the Chemical Institute of Shanxi, Xi'an; CHEN of Northwestern University, Xi'an

TITLE: "A Study of the Ternary System $LaCl_3$-Antipyrine-H_2O at 0°C and 20°C"

SOURCE: Shanghai HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese No 9, Sep 84 pp 913-915

TEXT OF ENGLISH ABSTRACT: The solubilities and refractive indices of the saturated solutions in the ternary system $LaCl_3$-antipyrine-H_2O at 0°C and 20°C are reported in this paper. Both the solubility and refractive index curves of the system at these two temperatures consist of three branches corresponding respectively to saturated solutions of three solid phases, i.e., antipyrine, $LaCl_3 \cdot 6$antipyrine$\cdot 7H_2O$ and $LaCl_3 \cdot 7H_2O$. The ternary complex $LaCl_3 \cdot 6$antipyrine$\cdot 7H_2O$ is incongruently soluble and its phase region is comparatively narrow at these two temperatures.

AUTHOR: FENG Sheng [7458 0524]

ORG: Department of Chemical Engineering, Guangdong Engineering Institute, Guangzhou

TITLE: "A Highly Sensitive Spectrophotometric Method for the Determination of Indium"

SOURCE: Shanghai HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese No 9, Sep 84 pp 916-920

TEXT OF ENGLISH ABSTRACT: A highly sensitive spectrophotometric method for the determination of microamounts of indium is described. The condition dealing with the formation of the ternary complex of indium (III) with 2,3,7-trihydroxy-9-phenyl-6-fluorone (PF) in the presence of cetylpyridium chloride (CPC) is presented. Beer's law is obeyed over the indium (III) concentration range up to 12 μg/25 mL. The ratio of constituents in the ternary complex is In (III):PF:CPC = 1:2:2. The molar absorption coefficient is 1.28×10^5 $L \cdot mole^{-1} \cdot cm^{-1}$ and Sandell's sensitivity is 0.9 $ng \cdot cm^{-2}$. The ternary complex has an absorption maximum at 570 nm, and is stable up to 4 hours at room temperature.

The recommended procedure is as follows: an aliquot of standard solution of indium (0-12 μg) is placed in a 25 mL volumetric flask and 3 mL of 2×10^{-2} M CPC and 1 mL of 3×10^{-4} M PF are added successively. Adjust the solution to a red color with dilute sodium hydroxide solution, and then add 5 mL of pH 8.3 buffer solution. After increasing up to volume with distilled water and shaking vigorously, the color intensity is determined against a blank at 570 nm. Satisfactory results have been obtained by the application of the proposed method in the determination of microamounts of In in indium-containing ores.

AUTHOR: KANG Jingwan [1660 2417 8001]
CHEN Ruyao [7115 1172 3852]
BAI Guangbi [4101 0342 1732]

ORG: All of the Department of Chemistry, Northwestern Normal College, Lanzhou

TITLE: "Derivative Absorption Spectra of the System of Lanthanides (Nd^{3+}, Ho^{3+}, Er^{3+})-1-Phenyl-3-Methyl-4-Benzoylpyrazolone-[5]-Diphenylguanidine and Its Analytical Application"

SOURCE: Shanghai HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese No 9, Sep 84 pp 921-924

TEXT OF ENGLISH ABSTRACT: The second and fourth derivative absorption spectra of the system of Ln^{3+} (Nd^{3+}, Ho^{3+}, Er^{3+})-1-phenyl-3-methyl-4-benzoylpyrazolone-[5](Hpmbp)-diphenylguanidine (DPG) have been determined by derivative spectrophotometry. The molar extinction coefficient (s) of fundamental spectrum and the molar derivative spectra are calculated. Using the mole ratio method of fourth derivative absorbance (dA), it is found that in the system of the ternary complex Nd^{3+}-Hpmbp-DPG, the ratio of components is 1:4:8. The results of analysis for the synthesized mixture of Nd^{3+}, Ho^{3+}, Er^{3+} suggest that fourth derivative spectrophotometry has higher resolution and sensitivity, and the linear relationship between dA and [Ln^{3+}] occurred. Therefore, the possibility of direct determination of an individual element in the mixture of rare earths by fourth derivative spectrophotometry exists.

9717
CSO: 4009/186

AUTHOR: DU Qishi [2629 1142 4258]
PENG Zhouren [1756 0719 0086]

ORG: Both of the Department of Chemistry, Lanzhou University

TITLE: "The ab initio Calculation of the Hellmann-Feynman Force and Its Applications to the Study of the Chemical Bond. III. Charge Distribution and the Chemical Bonds in the Molecules"

SOURCE: Shanghai HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese No 10, Oct 84 pp 1021-1025

TEXT OF ENGLISH ABSTRACT: In the present investigation, the criterion of the equilibrium of the electrostatic force is represented. According to this criterion and the results of the calculations and analysis of the Hellmann-Feynman (H-F) force, the distribution of the electronic charge in the molecule HF is explained, the change and the contributions of the $2p_x$ and 1 s electrons of atom F in the formation of molecule HF are discussed. The method of dividing the overlap populations with the H-F force is presented. The characteristics and distinctions of the ionic bond and the heteropolar bond are explained according to the H-F force. the method for calculating the angle of the bend bond of the strained molecules is presented, and the definition of the strain energy of the bend bond of the strained molecules is given. The angle of the C-C bond of cyclopropane calculated with this method is 22.32° and the strain energy is 0.4181 a.u.

AUTHOR: DAI Minguang [2071 7044 0342]
ZHENG Wei [6774 1218]

ORG: Both of the Department of Chemistry and Chemical Engineering, Fuzhou University

TITLE: "A New Method for the Rapid Determination of Pore-size Distributions with Frontal Chromatography"

SOURCE: Shanghai HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese No 10, Oct 84 pp 1026-1031

TEXT OF ENGLISH ABSTRACT: A new method for the rapid determination of pore-size distributions is developed. The theoretical equations are derived and the experimental procedures are described. It is noteworthy that in this new technique it is not necessary to consider the dead space or to calculate the amount of adsorption. The method is based only on measuring the peak height on the desorption portion of the frontal chromatographic curves and calculating the derivative of the corresponding point on the curves. The data processing is performed by a DBJ-Z80 microcomputer on-line and the pore-size distribution curves are plotted immediately with the printer. The method has been tested on benzene adsorption for Al_2O_3, SiO_2 and Fe-catalyzer, and good agreement with static data has been obtained. The proposed technique is more rapid and more reproducible than is the ordinary static method.

AUTHOR: CHANG Haoyong [1603 1170 0516]
DU Youru [2629 2589 1172]

ORG: Both of Changchun Institute of Applied Chemistry, Chinese Academy of Sciences

TITLE: "Synthesis of Mercury Rare Earth Ternary Sulfides"

SOURCE: Shanghai HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese No 10, Oct 84 pp 1040-1043

TEXT OF ENGLISH ABSTRACT: Three new sulfides of mercury and rare earth have been synthesized by heating a mixture of the sesquisulfide of rare earth and cinnabar at 800°C for 25 hours in an evacuated (10^{-4} Torr) sealed quartz tube. Their general formula, Ln_4HgS_7 (Ln=Tm, Yb and Lu), was determined by chemical analysis. These sulfides are tetragonal. Lattice parameters for Tm, Yb and Lu are: a = 11.09(2), 11.01(3) and 11.03(2) Å; c = 8.38(5), 8.35(2) and 8.33(2) Å respectively. These compounds are stable toward air and moisture at room temperature, but are oxidized slowly at elevated temperatures. Thermogravimetric curves show that Tm_4HgS_7, Yb_4HgS_7 and Lu_4HgS_7 are decomposed and oxidized at 500-600 and 480-580°C respectively.

9717
CSO: 4009/187

AUTHOR: YANG Qingchuan [2799 3237 0273]
LI Huali [2621 5478 4539]
et al.

ORG: YANG, et al., all of the Institute of Physical Chemistry, Beijing University; LI, et al., all of Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences

TITLE: "The Crystal and Molecular Structure of (Benzoylmethylenediphenylarsorano) (Triphenylphosphino) (Phenyl) Nickel (0)"

SOURCE: Shanghai HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese No 11, Nov 84 pp 1128-1132

TEXT OF ENGLISH ABSTRACT: The crystal and molecular structures of the title compound $C_{44}H_{36}OAsNiP$ have been determined using 3122 three-dimensional X-ray intensity data. The unit-cell constants are a = 13.833(6), b = 13.422(5), c = 20.216(9) Å; β = 100.60(4)°; space group $P2_1/n$; Z = 4. The final R factor is 0.041. The nickel atom is surrounded in an almost square planar arrangement by a triphenyl phosphine moiety, a σ-bonded phenyl group and a bidentateylide ligand bonded via O and As. The Ni-As bond of 2.268(1) Å has double-bond character. Also, the bond lengths and angles in the planar As-C(43)-C(44)-O-Ni five membered ring indicate a delocalized system As-C(43)-C(44)-O, which conjugates with C(1) ~ C(6) delocalized system through C(1)-C(44) bond with bond length 1.496(7) Å.

AUTHOR: DENG Jingfa [6772 2529]
DONG Shuzhong [5516 2885 1813]
et al.

ORG: DENG, et al., of the Chemistry Department, Fudan University; DONG, et al., of the Modern Physics Institute, Fudan University

TITLE: "Studies of Catalytic Behavior, Magnetic Property and State of Valency Electron of Ag-Pd Alloys"

SOURCE: Shanghai HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese No 11, Nov 84 pp 1133-1138

TEXT OF ENGLISH ABSTRACT: The catalytic behavior, magnetic property and state of valence electron of Ag-Pd alloys have been studied with X-ray diffraction, magnetic measurement, flow method for measuring catalytic activity and X-ray photoelectron spectroscopy. It is found that when the concentration of Pd in the Ag-Pd alloy is less than 40 mol percent, the main product for catalytic oxidation of methanol is formaldehyde, but with a catalyst containing Pd greater than 40 mol percent, the main products are CO and H_2. The magnetic property of the Ag-Pd alloy also changes with composition from diamagnetic into paramagnetic, the density of state at the Fermi level increases sharply, and the relevant variations of the d band width and its asymmetry of Pd in the alloy as observed with XPS. It is clearly shown that there is a correlation between the catalytic property and the electronic structure of Ag-Pd alloys, and the electronic factor can play an important role in the catalysis of Ag-Pd alloys.

AUTHOR: QIU Ling [6726 7117]
JIA Dongfang [6328 2639 2455]

ORG: Both of the Department of Modern Physics, Lanzhou University

TITLE: "The Problem with the Diffusion of Metallic Ion in the Exchange Process--Delay Time, the Cause of Formation and Related Rules"

SOURCE: Shanghai HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese No 11, Nov 84 pp 1139-1144

TEXT OF ENGLISH ABSTRACT: Using macrorecticular ion exchange resin of strong acidic type as stationary phase during the adsorption and desorption process, the problem associated with the diffusion of a metallic ion of high valency, such as UO_2^{2+}, U(IV), etc., was studied systematically by the shallow bed method. The existence of delay time in the diffusion process is confirmed and a model of the adsorption double layer on the interface is suggested whereby the cause of formation and related rules concerning the delay time are explained.

AUTHOR: HE Shaoqi [0149 1421 3825]
WU Jinguang [0702 3866 0342]
ZHANG Qinglian [1728 7230 5571]

ORG: All of the Department of Chemistry, Beijing University

TITLE: "Mid-Infrared Spectra of the Crown Ether Complexes of Lithium Perchlorate"

SOURCE: Shanghai HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese No 11, Nov 84 pp 1183-1187

TEXT OF ENGLISH ABSTRACT: With a Nicolet 7199B Fourier Transform Infrared Spectrometer and the nujol mull technique, the mid-infrared spectra in the region of 600-3600 cm^{-1} have been observed for triethylene glycol phthalate (phthalyl-14-c-4), 15-crown-5 (15-c-5), 18-crown-6 (18-c-6) and sym-dibenzo-24-crown-8 (dibenzo-24-c-8), and also their $LiClO_4$ complexes: $LiClO_4$·phthalyl-14-c-4, $LiClO_4$·15-c-5·H_2O, $2LiClO_4$·18-c-6·2THF·$3H_2O$ and $2LiClO_4$·dibenzo-24-c-8·$3H_2O$. Spectroscopic assignments have been made for 10 different modes of vibrations. The infrared shifts due to complex formation are interpreted regarding the location of water molecules, the coordination of Li^+ and ClO_4^- ions, frequency regions of C-O-C and C-C-O groups, splitting of the C-O peak and the small displacement pertaining to the benzo-group. In addition, the isotopic shift of the H_2O band due to ^6Li and ^7Li amounts to about 8 cm^{-1}.

AUTHOR: LI Xingfu [2621 6821 1133]
Fischer, R.D.
Bagnall, K.W.

ORG: LI of the Institute of High Energy Physics, Chinese Academy of Sciences, Beijing; Fischer of the Institut fur Anorganische und Angewandte Chemie, Universitat Hamburg, FRG; Bagnall of the Department of Chemistry, University of Manchester, England

TITLE: "Application of Cone Packing Model in Prediction and Preparation of New Patterns of f Group Organometallics"

SOURCE: Shanghai HUAXUE XUEBAO [ACTA CHIMICA SINICA] in Chinese No 11, Nov 84 pp 1214-1217

TEXT OF ENGLISH ABSTRACT: New coordination patterns of $M_2[AnCp(NCS)_5]$(An = U(IV), M = Ph_4As^+, Ph_4P^+, n-Bu_4N^+) and $LnCp_3L_2$ (Ln = La, L = MeCN, EtCN), expected according to the cone packing model are prepared and characterized.

9717
CSO: 4009/188

AUTHOR: WU Xin'gan [0702 9515 1626]

ORG: Jinzhou Refinery

TITLE: "Production of Oil-extended cis-1,4-Polybutadiene Rubber by Nickel Catalyst Systems and Its Properties"

SOURCE: Lanzhou HECHENG XIANGJIAO GONGYE [SYNTHETIC RUBBER INDUSTRY] in Chinese No 4, Jul 84 pp 260-263

TEXT OF ENGLISH ABSTRACT: The base rubber used for the production of oil-extended cis-1,4-polybutadiene rubber (BR) was manufactured by solution polymerization of butadiene with nickel catalyst systems prepared by altering the component ratios and the sequences. The oil extending was then carried out by a two-stage batchwise process in which the quantities of extended oil could be precisely controlled within 37.5±1.5 percent. The extending oils refined by phenol or furfural extractions consist of the third, fourth, sixth line extracted oils and heavy remainder oils, of which the latter is the best. The physical properties of the vulcanizates of the oil-extended BR have reached the second grade of the BR specifications issued by the Ministry of Chemical Industry, and the processing and extruding properties are good. This oil-extended BR can be used in combination with natural rubber in a 50:50 ratio as tire tread.

AUTHOR: SHEN Qi [3088 3825]
YANG Guojie [2799 0948 3381]
WANG Fusong [3769 0154 2646]

ORG: All of Changchun Institute of Applied Chemistry, Chinese Academy of Sciences

TITLE: "Effects of Polymerization Conditions on Molecular Weight and Molecular Weight Distribution of the Copolymer of Butadiene and Isoprene with Rare Earth Catalysts"

SOURCE: Lanzhou HECHENG XIANGJIAO GONGYE [SYNTHETIC RUBBER INDUSTRY] in Chinese No 4, Jul 84 pp 280-283

TEXT OF ENGLISH ABSTRACT: The effects of polymerization temperature, the conditions for catalyst preparation, the amount of catalyst used and the Al/Nd molar ratio on molecular weight and molecular weight distribution of butadiene-isoprene copolymers prepared with $Nd(naph)_3$-$Al(i\text{-}Bu)_3$-$Al_2Et_3Cl_3$ catalyst system were studied. The results show that the molecular weight of the copolymer decreases and the molecular weight distribution of the copolymer broadens with increases in polymerization temperatures, catalyst amounts and Al/Nd ratios. This is attributed to the chain transfer reaction to alkyl-aluminum during the polymerization process. The "living polymerization system" without chain transfer reactions can be obtained when the Al/Nd ratio is reduced to 20. By means of "seed polymerization," in which a small amount of monomer is added to the mixture of the catalyst components, the copolymers with high molecular weights and narrow molecular weight distributions are produced.

AUTHOR: WANG Ying [3769 5391]
QIN Wen [4440 3080]

ORG: Both of Changchun Institute of Applied Chemistry, Chinese Academy of Sciences

TITLE: "Viscosities of Concentrated Solutions of cis-Polybutadiene Rubber"

SOURCE: Lanzhou HECHENG XIANGJIAO GONGYE [SYNTHETIC RUBBER INDUSTRY] in Chinese No 4, Jul 85 pp 304-307

TEXT OF ENGLISH ABSTRACT: The viscosities of concentrated solutions of cis-polybutadiene rubber (BR) produced by four catalyst systems have been measured by a coaxial cylinder viscometer and the falling-ball method. It was found that the zero-shear viscosity of a BR solution prepared with a lanthanide catalyst (Ln-BR) was the highest among the BRs investigated in spite of its lowest Mooney values. For each rubber above, the $\eta_{\dot{\gamma}}/\eta_0$ vs $\eta_0\dot{\gamma}$ curves with different solvents and at different concentrations superimpose each other within a rather narrow band. The Ln-BR shows the most pronounced tendency toward non-Newtonian flow. All the phenomena have been discussed according to their molecular weight distribution and branching characteristics.

9717
CSO: 4009/176

AUTHOR: LIU Yuzhi [0491 3768 5347]
et al.

ORG: Yanshan Petrochemical Corporation, Research Institute, Beijing

TITLE: "Hydrofining Test of Discharged Oil from the Solvent for cis-Polybutadiene Rubber Production"

SOURCE: Lanzhou HECHENG XIANGJIAO GONGYE [SYNTHETIC RUBBER INDUSTRY] in Chinese No 5, Sep 84 pp 337-343

TEXT OF ENGLISH ABSTRACT: The accumulation of impurities in the solvent commonly used in domestic cis-polybutadiene rubber production had been a problem during the recycling of the solvent. A new method by catalytic hydrogenation of the solvent was developed to reduce the solvent impurities and to improve the quality of the rubber products. The hydrofining experiments on the discharged solvent oil were carried out with homemade catalyst No 0501 and operated at temperatures of 150-200°C, atmospheric pressure, hydrogen-to-oil ratio of 400 and an empty tube velocity of 1.5-2.0 m^3/hr. The results demonstrate that this treatment can effectively remove the impurities in the discharged solvent. After the hydrofining, the qualities of the solvent proved to satisfy the requirement for the polymerization and to increase the yield of the rubber as well.

AUTHOR: LI Keyou [2621 0344 0645]
LI Zheling [2621 0772 7227]

ORG: Both of the Department of Polymer Science and Materials, Chengdu University of Science and Technology, Chengdu

TITLE: "A Study of the Molecular Structure and Properties of Carboxylated Polychloroprene Latex Produced in Pilot Plant"

SOURCE: Lanzhou HECHENG XIANGJIAO GONGYE [SYNTHETIC RUBBER INDUSTRY] in Chinese No 5, Sep 84 pp 343-347

TEXT OF ENGLISH ABSTRACT: Results show that the latex with particle size 0.05-0.1 μ contains 0.05-0.1 percent of chloroprene residue and remains very stable at temperatures of -10 - 80°C and pH 1-12. The polymer with the brittle point of -40 - -30°C for the latex film possesses higher resistance to acids, bases and salts. The molecular structure, as measured by X-ray diffraction and IR spectroscopy, is a random polynary copolymer of the monomers. This latex can be successfully applied to waterproof roofing coats and binders for wood, concrete, rubber, plastics and many other materials.

9717
CSO: 4009/178

JPRS-CST-85-018
12 June 1985

AUTHOR: LIU Guanzhong [0491 6034 1813]
et al.

ORG: Division of Catalysis, Chemical Engineering Research Institute, Lanzhou Chemical Industry Corporation

TITLE: "Study of the Oxidative Dehydrogenation of Butylene to Butadiene on Ferrite Catalyst"

SOURCE: Lanzhou HECHENG XIANGJIAO GONGYE [SYNTHETIC RUBBER INDUSTRY] in Chinese No 6, Nov 84 pp 432-438

TEXT OF ENGLISH ABSTRACT: The reaction condition and results on ferrite catalyst F-84-13 with spinal structure which did not contain chromium compound for producing butadiene by oxidative dehydrogenation of butylene were studied in a ϕ76 mm fluidized bed. It has been shown that the catalyst has many advantages, such as high activity, high selectivity, low oxygenated compound, good mechanical strength and good thermal stability over a wide range of reaction conditions. It was found that, for a 721 hour run of the reaction, the yield and selectivity of butadiene, oxygenated byproducts and acetylene content in the effluent were 70.44 percent, 92.08 percent, 0.82 percent and 42.50 ppm respectively.

AUTHOR: YAN Chunzhen [7051 2504 3791]
WANG Zhe [3769 0772]
TANG Xueming [0781 1331 2494]

ORG: All of Changchun Institute of Applied Chemistry, Chinese Academy of Sciences

TITLE: "The Effect of Preparation Method of Molybdenum Catalyst System on Its Polymerization Activity"

SOURCE: Lanzhou HECHENG XIANGJIAO GONGYE [SYNTHETIC RUBBER INDUSTRY] in Chinese No 6, Nov 84 pp 443-447

TEXT OF ENGLISH ABSTRACT: 1,2-polybutadiene has been synthesized by using $MoCl_3(OC_8H_{17})_2$-$(i\text{-}Bu)_2AlOPh$ as catalyst and aliphatic hydrocarbon as solvent. The effects of preparation conditions on the activity of the catalyst were studied. The T_g, molecular weight distribution, microstructure and physical-mechanical properties of the polymer have been characterized.

9717
CSO: 4009/179

JPRS-CST-85-018
12 June 1985

AUTHOR: LI Yongjin [2621 0737 0093]

ORG: Northwest Institute of Rubber Products, Ministry of Chemical Industry, Xianyang

TITLE: "A Mathematical Model of Physical Property Changing of Vulcanizates During Heat Aging"

SOURCE: Lanzhou HECHENG XIANGJIAO GONGYE [SYNTHETIC RUBBER INDUSTRY] in Chinese Vol 8 No 1, Jan 85 pp 38-41

TEXT OF ENGLISH ABSTRACT: A mathematical model is proposed to describe the relationship of physical property changes (y) of vulcanizates with aging temperature (T) and aging time (t) during heat aging:

$$y = \frac{B}{10^{10}(B_0+B_1x_1+B_2x_2)}$$

where $x_1 = 1/T$, $x_2 = \log t$; B, B_0, B_1 and B_2 are constants independent of aging temperature. They can be estimated by the random try method. The experimental results obtained are quite coincident when using the author's model.

AUTHOR: LIU Yuying [0491 3768 5391]
et al.

ORG: Both of the Changshou Chemical Plant, Changshou, Sichuan Province

TITLE: "Synthesis of Chloroprene Rubber Used as Substrate for Grafting with Olefines"

SOURCE: Lanzhou HECHENG XIANGJIAO GONGYE [SYNTHETIC RUBBER INDUSTRY] in Chinese Vol 8 No 1, Jan 85 pp 46-48

TEXT OF ENGLISH ABSTRACT: Chloroprene rubber named LDJ-244, which is used as the substrate for graft copolymerization with olefines, is synthesized by emulsion polymerization. Experimental results show that the polymerization temperature and the use of a molecular weight modifier, antioxidant and terminator exert great influences on the reactivity of the chloroprene rubber in graft copolymerization and on the adhesive ability with other components in grafted copolymers.

This chloroprene rubber possesses features such as fast rate of crystallization, high strength of coagulated rubber and easily graft-copolymerized with olefine monomers.

9717
CSO: 4009/180

Computer Applications

AUTHOR: ZHU Mingquan [2612 2494 2938]

ORG: None given

TITLE: "A Method of Optimum Design for Combined Structures of Large Dimensions"

SOURCE: Beijing SHUZHI JISUAN YU JISUANJI YINGYONG [JOURNAL ON NUMERICAL METHODS AND COMPUTER APPLICATIONS] in Chinese Vol 6, No 1, Mar 85 pp 19-32

TEXT OF ENGLISH ABSTRACT: In optimum design for combined structures of large dimensions, there are two important problems in the calculation: excessive time for re-analyzing the combined structures and the very complicated nonlinear constraints. In the light of aeronautic structure optimum design practice, a new method, with which the nonlinear constraints can be directly processed, is presented in this article. With this method, the iterative scheme is simpler and the time of re-analyzing combined structures is less. An optimum solution that meets the engineering requirements for combined structures of large dimensions can be obtained with only 10 iterative steps. Using this method, we have calculated an example of optimum design for a whole helicopter structure with constraints of stresses, displacements, stabilities and minimum sections, including over 1,000 independent design parameters and more than 3,000 degrees of freedom. The optimum sections of all the elements under stress were obtained after 10 times of iteration.

The iterative scheme of the method and the results of some computing examples are given in the paper.

Paper received on 5 July 1982.

CSO: 4009/1019

Electronics

AUTHOR: LI Shengpei [2621 5116 3099]
LIU Guifen [0491 2710 5358]

ORG: Institute of Electronics, Academia Sinica

TITLE: "Design of a PM-Focusing System for the Gyrotron"

SOURCE: Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 6, No 6, Nov 84 pp 490-494

TEXT OF ENGLISH ABSTRACT: A new PM-focusing system with two regions of uniform magnetic field, suitable for gyrotron is proposed and studied with computer. In the calculation, a radial system made of Sm-Co magnets is used. The maximum magnetic energy-products $(BH)_{max}$ of the magnets are about 20 MGOe. In order to adjust the magnitude of the magnetic field, some small coils are inserted into the two regions so that about five percent field change can be obtained.

As a computed example a 40-50 kg Sm-Co PM-focusing system for an 8 mm band H_{02} mode gyromonotron operating at secondary harmonic of the cyclotron frequency is needed to obtain an intense magnetic field of 6500-7000 Gs. This is very attractive for the development of 8 mm band gyrotrons and near-centimetre band ones. In the last part of the paper some problems such as the extension of the uniform region and increasing the efficiency of magnetic circuit are briefly discussed.

AUTHOR: LIU Yongquan [0491 3279 6898]
WU Jingxian [0702 7234 6343]
LIU Yanyuan [0491 3508 3293]
GUO Kaizhou [6753 7030 0719]

ORG: Institute of Electronics, Academia Sinica

TITLE: "A New Depressed Collector Grid Control Pulsed TWT"

SOURCE: Beijing DIANZI KEXUE XUEKAN [JOURNAL OF ELECTRONICS] in Chinese Vol 6, No 6, Nov 84 pp 503-504

TEXT OF ENGLISH ABSTRACT: A grid control pulsed TWT with depressed collector and PPM focusing system is reported. It operates at X-band and delivers peak output power of 1 kW with saturation gain of 47 dB. The duty cycle is 3 percent. The electron beam transmission is 95 percent with RF output at saturated condition. The efficiency is not less than 30 percent (excluding the heater power).

CSO: 4009/1022

Optics

AUTHOR: ZHANG Fangqing [1728 0119 3237]
CHEN Guanghua [7115 0342 5478]
LIU Zhi [0491 2535]
WANG Huisheng [3769 2585 3932]

ORG: None given

TITLE: "An Investigation of the Optical Constants of GD a--Si_xC_{1-x}:H (B) Films"

SOURCE: Lanzhou LANZHOU DAXUE XUEBAO (ZIRAN KEXUE BAN) [JOURNAL OF LANZHOU UNIVERSITY (NATURAL SCIENCE EDITION)] in Chinese Vol 20, No 3, 28 Sep 84 pp 31-35

TEXT OF ENGLISH ABSTRACT: Experimental results are reported of the optical constants of GD a--Si_xC_{1-x}:H (B) films. The relations between the refractive index n, imaginary part of the dielectric constants ε_2 and the wavelength have been measured in visible light range (4000-7000A), respectively. It has been found that a smooth peak appears for both n and ε_2 and the values of n and ε_2 decrease with the increase of carbon content. A preliminary discussion is presented.

CSO: 4009/1010

JPRS-CST-85-018
12 Jume 1985

AUTHOR: HE Qizhi [0149 0796 2535; deceased]
YANG Jianhua [2799 1696 5478]
CHENG Guojun [4453 0948 0971]
YANG Rongfu [2799 2837 6534]

ORG: HE and CHENG both of Sichuan University, Chengdu; YANG Jianhua of Dalian Light Industry College; YANG Rongfu of Kashi Teachers College, Xinjiang

TITLE: "A Search for π-N Interaction by Quark Model"

SOURCE: Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 34 No 1, Jan 85 pp 1-9

TEXT OF ENGLISH ABSTRACT: By means of a quark potential model and Warke approximation, and introducing as the compensation intermediate potential $(-1)^{T+J}K_{re}^{-r/a_2}$ in the phenomenological one gluon exchange quark interaction potential, the pion-nucleon interaction potential is calculated. The phase shifts of π-N scattering in the six channels S_{11}, S_{31}, P_{11}, P_{31}, P_{13}, and P_{33} are determined for the incident pion kinetic energy in the laboratory coordinate system up to 700 MeV. These results are compared with the experimentally determined phase shifts.

AUTHOR: SHE Yongbo [0152 3057 2672]
CHEN Yunfang [7115 7301 5364]
ZHAO Ruwen [6392 3067 2429]
ZHANG Xiulan [1728 4423 5695]
PAN Guangyan [3382 1639 3508]

ORG: All of the Institute of Physics, Chinese Academy of Sciences

TITLE: "On the Line Broadening and Shifts of Al-Laser Produced Plasma"

SOURCE: Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 34 No 1, Jan 85 pp 10-16

TEXT OF ENGLISH ABSTRACT: We have studied the spatially resolved spectra of Al-laser produced plasma. In the range from 2300-4000 Å about 30 emission lines have been observed belonging to the neutral, singly and doubly ionized Al species. Their line widths and shifts vary with the distance between the plasma and the Al-target surface. Five lines from differently ionized species have been examined with the aid of the theoretical formula given by Griem, and the distribution of electron density near the target has been determined semi-empirically. We found that the line broadening of the different species coincided well with each other, and could be used as a measure of electron density in the range from $1 \cdot 10^{17}$ to $5 \cdot 10^{18}$ cm^{-3}. However, the coincidence between the line shifts seems not to be so good, especially for the lines of 3587 Å of Al II and 3610 Å of Al III. This should be investigated further.

AUTHOR: GUO Yili [6753 1150 3810]
DING Haishu [0002 3189 2562]
YAO Minyan [1202 2404 6056]
ZHOU Shouhuan [0719 1108 2719]
et al.

ORG: GUO, DING and YAO, et al., all of Qinghua University, Beijing; ZHOU of the North China Research Institute of Electro-optics

TITLE: "Threshold and Energy Transfer Efficiency in High Pressure Hydrogen SRS"

SOURCE: Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 34 No 1, Jan 85 pp 24-31

TEXT OF ENGLISH ABSTRACT: In this work, the influences of several parameters (molecular density of medium, transition linewidth, photon density of pump laser and nonlinear interaction length) on high pressure H_2 stimulated Raman scattering (SRS) threshold and energy transfer efficiency are investigated. The experiments were carried out on a Q(1) line vibration transition (4155 cm^{-1}) SRS. Results of the effect of H_2 pressure (0 to 24 atm) on the threshold are coincident with the analysis of the combined effect of Dicke-Doppler and collision broadening. The influences of stimulated Raman process (SRP) and four-wave parametric processes (FWPP) on energy transfer efficiency as well as the role of pressure-dispersion effect on higher order anti-Stokes are also discussed.

AUTHOR: YAO Jie [1202 2638]
CHEN Baoqiong [7115 1405 8825]
WANG Hongkai [3769 1347 2818]

ORG: YAO and CHEN both of the Department of Physics, Zhongshan University, Guangzhou; WANG of the 46th Institute, Ministry of Electronics Industry

TITLE: "Inversion of p-Type Silicon to n-Type by Pulsed Laser Irradiation"

SOURCE: Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 34 No 1, Jan 85 pp 117-120

TEXT OF ENGLISH ABSTRACT: This paper describes an effect of the inversion of silicon single crystal from p-type to n-type by the irradiation of a ruby pulsed laser. This effect is a function of the impurity compensation but independent of the oxygen content, the crystal cut and the crystal-growing process. Experimental results show that p-type silicon crystals with phosphorus impurity compensation higher than 7 percent are susceptible to inversion by pulsed laser irradiation when the amount of impurity compensation increases and the distribution of impurity compensation changes. The concentration profile of phosphorus atoms is given by the SIMA technique.

9717
CSO: 4009/168

JPRS-CST-85-018
12 June 1985

AUTHOR: PANG Jufeng [1690 1565 0023]
ZHENG Guifang [6774 2710 5364]
ZHANG Yawei [1728 0068 0251]

ORG: All of Shaanxi Provincial Research Institute of Preventive Medicine, Xi'an

TITLE: "Analysis of Radioactive Nuclides in Soil Around Xi'an City"

SOURCE: Beijing ZHONGHUA FANGSHE YIXUE YU FANGHU ZAZHI [CHINESE JOURNAL OF RADIOLOGICAL MEDICINE AND PROTECTION] in Chinese No 6, 25 Dec 84 pp 33-38, 76

TEXT OF ENGLISH ABSTRACT: The radioactive nuclides in soil samples collected from the wasteland and cultivated land in 24 communes around Xi'an City were analyzed by means of Ge(Li) gamma-ray spectrometry. The distributions of the radioactive nuclides in various regions and at various soil depths have been investigated. The mean levels of the radioactive nuclides in the soil from these 24 communes are: ^{238}U 1.13±0.17, ^{226}Ra 1.00±0.08, ^{232}Th 1.46±0.08, ^{40}K 18.5±0.6, and ^{137}Cs (depth 10 cm) 0.15±0.06 pCi/g for the wasteland (depth of 20 cm was divided into four layers); ^{238}U 1.16±0.35, ^{226}Ra 0.98±0.09, ^{232}Th 1.45±0.08, ^{40}K 18.6±0.9 and ^{137}Cs 0.15±0.05 pCi/g for the cultivated land (10 cm deep, only one layer). The gross α and radioactivities in the soil samples of the 24 communes were also measured and were found to average at 21±10 and 30.0±2.9 pCi/g for the wasteland, and 19±12 and 28.6±3.4 pCi/g for the cultivated land, respectively.

9717
CSO: 4009/205

Thermodynamics

AUTHOR: YE Kaiyuan [0673 7030 3104]
LIU Ping [0491 1627]

ORG: Lanzhou University, Lanzhou

TITLE: "Steady-State Conduction of a Disc With Non-Homogeneity and Variable Thickness"

SOURCE: Chongqing YINGYONG SHUXUE HE LIXUE [APPLIED MATHEMATICS AND MECHANICS] in Chinese Vol 5, No 5, Sep 84 pp 619-624

TEXT OF ENGLISH ABSTRACT: In this paper, we use the stepped reduction method suggested by Ye Kaiyuan in 1965 to obtain the general solution of steady-state conduction of a disc with non-homogeneity and variable thickness. Through an illustrative example, the error of Ye's method is analyzed for the first time. The result shows that it is effective for solving ordinary differential equation with variable coefficients.

CSO: 4009/1021 END