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ADVANCED MATERIALS

FRG Tests New Device for Checking Fiber-Matrix Bond in Composites

36980039 Duesseldorf VDI NACHRICHTEN in German 2 Oct 87 p 32

[Text] Extremely small forces can be measured and thus more knowledge about the micro-sized world between fibers and plastics can be obtained by using a measurement procedure developed at the Federal Institute for Material Testing (BAM) in Berlin. Modern high-performance composite materials today have strengths equivalent to those of titanium alloys or steels. With these materials, plastics are becoming tailor-made materials for special applications. The fibers used in the polymer matrix include glass fibers and also carbon fibers or polyaramid fibers.

On the occasion of a colloquium of the Institute with which the 60th birthday of its president, Prof G. W. Becker, and the 40-year existence of the Standards Committee for Material Testing was celebrated, Federal Institute member Dr A. Hampe reported on studies of the adhesion of individual fibers in re-inforced polymers.

The crucial factor in the strength of high-performance composite materials is the bonding between the fibers—which have a diameter of 5-20 micrometers—and the polymer matrix. Dr Hampe believes it is difficult to measure this bonding on finished materials and therefore hardly provides satisfactory results. Only mean values for ten thousands of fibers can be determined.

Therefore, a sophisticated procedure by means of which the bonding power can be determined on individual fibers was developed at the BAM institute.

In this procedure, the fibers are embedded in a drop of the polymer—specifically, for a length of several hundred micrometers. The drop itself may have a diameter of 1 mm.

This theoretically ideal measurement procedure is very difficult to implement on an experimental basis, because the fibers would be so thin and the resulting forces would be extremely small. Nevertheless, according to Dr Hampe, the BAM has succeeded in constructing the precision mechanics equipment to do so. This equipment makes it possible to precisely adjust the temperature for embedding and to measure the extraction force with a resolution of 0.1 mN, which Dr Hampe compares with the force of a fly sitting on your hand.

In the equipment, the fiber is pulled from the matrix at 1mm/h, which results in a trial time lasting a few minutes. A resolution of 0.1 micrometer is achieved during velocity measurement.

The procedure has produced force movement diagrams which would usually start with a linear force increase during the initial segment of the movement. The fiber is continuously elongated until it starts to slip out of the polymer drop. The start of this second phase is marked by a drop in the force curve, whose shape and slope are determined by the interaction between fiber and polymer. A contributing factor here is the sliding friction that is determined by the adhesion to the interfaces.

Dr Hampe presented as typical measurement results curves that were obtained from glass fibers in polycarbonate and that resulted in a maximum force of 240 mN for the start of the extraction. Scanning electron microscope photos complement these measurement results, because they reveal the affect the bonding agent has on the fiber surface.

For example, the measurements reveal that improvements can be achieved for glass fibers in polycarbonate by using bonding agents. A higher strength would be attained. Random check measurements showed that the maximum force is proportional to the embedded length, as was also generally expected. The transverse strength of the interface can be determined from the proportionality constant. In future studies at the BAM, the objective will be to analyze the sound emitted when a fiber is extracted or when it tears.

Photo Captions [Photos Not Reproduced]

The glass fiber is drawn out of the polyamid matrix (below). The break is clearly visible at the top of the scanning electron microscope picture.

The extremely small sample bodies were created in Berlin by using this precision mechanics equipment: The extraction tests on high-performance composite materials involves placing a reinforcement fiber in a drop of polymer.

12399/9274

FRG: Bakelite Development of Advanced Materials Outlined

3698m070 Duesseldorf VDI NACHRICHTEN in German No 42, 16 Oct 87 p 6

[Article by Arnulf Schoebitz: "With Bakelite in Space"]

[Excerpt] VDI-N, Iserlohn-Letmathe, 16/10/87—A feature that has remained typical of the [Bakelite] company is its technology-based policy. Dr Eng Bert Meier, director of research and development in the Duisburg-Meiderich factory (the headquarters are in Iselohn-Letmathe and another factory operates in Frielendorf near Kassel) states:

"If we were not a technically run factory, we could not have obtained the position in hi-tech production that we have reached." With great discretion, he does not mention that in many fields Bakelite occupies a leading position on the world market—as far as phenolic resins are concerned the company is the leader on the European market. This accounts for one-third of sales and, according to external estimates, the sales share for epoxy resins should be around 30 percent. The remainder is derived from hardenable molded materials.

The fact that 5 percent of sales is spent for R&D—primarily applications research, excluding quality control—speaks for this technology oriented company. The fact that it takes a number of years for a product to be widely distributed is accepted as a matter of course. At one-tenth, the proportion of total manpower employed in R&D is above average when compared with other companies with a similar structure.

Bakelite produces and processes synthetic materials for the Rutger company. The focal point of production are superior quality products that are designed to meet special demands, the most important being phenolic resins and epoxy plastics, and hardenable molded material. Bakelite, a pioneer in the production of synthetic materials, is today one of Europe's leading producers of duroplastics. With an annual capacity of over 160,000 tons the company is among the largest manufacturers.

Management pride lies in the fact that "hardly any other producer has combined so many different hardenable synthetic material categories in one marketing program." Over 2,000 products are offered. With the successful advances in petrochemicals, meanwhile, thermoplastics have conquered three-quarters of the world synthetic material market of 65 million tons per year. On the other hand, duroplastics are being introduced into new fields as substitutes for traditional materials such as metal, glass, or ceramics.

Thanks to their resistance to fire, temperature and water resistance, as well as resistance to corrosive chemicals, duroplastics are welcome "assistants" in the production of related products. This is the case, for example, in automobiles, in which—usually hidden under the hood or other materials—on average approximately 15 kg per car have been used. Pistons made of hardenable molded materials replace heavy steel pistons in hydraulic auto brakes in U.S. models. Thanks to low heat conductivity, the brakes are more stable and no longer fade. Also, overheating and buildup of bubbles in hydraulic oil are things of the past.

Extremely pure special phenolic plastics are used to form the hermetically sealing carbon shells of the 6 cm combustion spheres containing a mixture of uranium and thorium in the Thorium High Temperature Reactor (THTR) in Schmehausen. Bakelite casting resin systems have to stand a crucial test in the world's largest superconductive magnetic coil in the nuclear research center in Karlsruhe (KFK).

The coil shell, which has been manufactured in cooperation with Siemens, weighs 18 tons. In practical operation it is cooled with helium at a hypercritical [temperature] of 4 Kelvins, and a carbon plasma that burns at 100 million degrees is ignited in a magnetic field produced by superconductivity which is 150,000 stronger than the earth's magnetic field. The artificial resin must be able to stand the enormous temperature changes without cracking.

Recently, since the European missile Ariane has been able to carry two satellites instead of just one as a normal load, it has become clear even to non-professionals that the increase in payload is effective. Bakelite products play a role here as well. The new payload shell of Ariane 4 consists of carbon-fiber-reinforced sandwich composites. The special epoxy resin binding agents necessary for this process were developed at Bakelite.

Within a long-term research program, which includes the BMFT [Federal Ministry for Research and Technology] (which provides one-half of the funds, that is, DM1.5 million), the current producers of binding agents (Bakelite), fiber manufacturers and suppliers of pure-impregnated fiber semi-products ("prepegs"), in cooperation with a technical institute, are attempting to further raise the useful permanent damage limits for temperature and dampness effects through continuous improvements in the binding stability of the resin matrix and carbon fibers.

08701

AEROSPACE, CIVIL AVIATION

DFVLR Develops Testbed for Advanced Aircraft Design

3698m102 Bonn BMFT JOURNAL in German No 4, Aug 87 p 12

[Text] In close cooperation with Messerschmidt-Bolkow-Blohm, the DFVLR [German Experimental Institute for Aeronautics and Astronautics] has reconstructed an FVFW 614 aircraft to create a versatile, high-performance experimental aircraft. ATTAS (Advanced Technologies Testing Aircraft Systems) is a testbed designed for the testing of new forms of aircraft controls, navigation and equipment. The aircraft has been equipped with a fully digital fly-by-wire system and with a modern avionics system.

With ATTAS a future oriented testbed has been created which, particularly as far as research is concerned, will permit experimental investigation of aircraft piloting, flight control, flight mechanics, and equipment. This has led to the possibility of testing BMFT [Federal Ministry

for Research and Technology] projects in the above fields—using a testbed which represents a whole range of transportation aircraft. The possibility of obtaining sufficiently reliable and transferable evidence of the performance of the products of the FRG aviation industry products will contribute to the protection and consolidation of the FRG's industrial competitiveness at international level.

ATTAS will play an essential role in future BMFT subsidy programs. The research periods for the first 2 test years had already been fully booked before final completion [of the ATTAS] this summer.

Other experimental equipment permit the creation of future plans for flight-function demonstrations without the need for complex changes.

In this way, through full implementation of in-flight simulation capabilities, it is possible to insert into ATTAS the flight behavior of new aircraft such as future Airbus variations, a planned 80-seater or—within the limits of the F VFW 614—a hypersonic aircraft.

08701

Technical Characteristics of Hermes Spacecraft Described

3698m105 Rome SCIENZA DUEMILA in Italian No 11, Nov 87 pp 17-19

[Article by Alberto Mondini: "Hermes: The European Spacecraft Project Is Now A Reality"]

[Excerpts] The successful launching on 15 September of the Ariane carrier rocket from the Kourou base, located on the equator in French Guyana, not only put into orbit the European ECS-4 [European Communications Satellite] and Australian K3 Aussat telecommunications satellites; the V-19 launch also raised morale at ESA (European Space Agency), which had sunk to a very low level after the Ariane failure of 30 May 1986.

For next year there are eight launches in store with an important new element: Ariane 3 will give way to Ariane 4 or, to be more precise, Ariane 4/44LP. The rocket will have four boosters, two using solid propellant and two with liquid propellant, while the Ariane 3 used in the V 19 had only two solid-propellant boosters and its takeoff weight was 238,986 kg.

But Europe wants to put itself on an equal footing with the two superpowers and to launch a manned shuttle, the Hermes. This will require the use of a carrier rocket of the latest generation—the Ariane 5—capable of launching payloads of 10-15 tons into low orbit and payloads of 2-3 tons into geostationary orbit.

Hermes, the European Shuttle

Hermes will have a total mass of 21 tons and will orbit the earth at a height of 500 km with an inclination of 28.5 degrees. This mass includes 3 tons of payload and 1.5 tons of propellant. A second orbit, termed heliosynchronous, is also planned at a height of 800 km and with a 99-degree inclination. Hermes can remain in space for 1 week and service various space stations, whether U.S., European, or Soviet [stations]. It can also be moored to a space station for periods of up to 3 months. Once in orbit, it can interact with automatic platforms and satellites and can perform towing and assembly missions. It normally will carry four people: two pilots and two people responsible for conducting experiments. However, in emergencies, if it has to carry out a rescue mission in space, it can transport four passengers in addition to the two pilots. At the end of a mission, Hermes, just like the U.S. shuttle, will have to re-enter the atmosphere and glide to land on an airstrip. Its landing speed will be lower than that of the U.S. shuttle: it is estimated that the wheels will touch down at a speed of 85 meters per second, or 306 km per hour, and it will travel only 1,500 meters (2,000 if the airstrip is wet) before coming to a stop. Landings are scheduled at the Kourou airport, but any international airport landing strip will be adequate.

After numerous postponements, Hermes' first manned mission is now scheduled for 1997. This [mission] will be preceded by an unmanned flight (a new feature compared with the U.S. shuttle), which will be conducted using a standard-size version with special modifications to enable unmanned operation.

The 21-ton weight, considerably higher than that originally planned, will require an updated version of the Ariane 5 launcher with upgrading of the solid propellant boosters and the liquid propellant stage. With these modifications, the launcher will be able to put 21 tons into low orbit and 5.9 tons into a geostationary transfer orbit (that is, an elliptical orbit reaching the 36,000 km of the geostationary orbit at its apogee; at this height the satellite's apogee engine will make the orbit circular). This represents a 22-percent improvement over the previous version. Thus, in 1995, Europe should be able to put a space station the size and weight of the Soviet Mir into orbit with its own resources. Ariane 5's overall reliability is 0.98 percent, but for launching of the manned Hermes flight the security factor has to be increased to 0.999 percent or, in other words, there can only be one chance in a thousand of malfunction. Therefore, it is possible that Hermes' first manned mission may be postponed to the middle of 1998, with the second mission at the beginning of 1999.

Hermes Will Service Columbus

Hermes, a project which originated in France, and Columbus, an Italian-FRG project, are both ESA projects now.

Hermes' principal function is to service two different Columbus applications: the pressurized module hooked onto the U.S. space station and the free-flying platform. Servicing the free-flying platform will require an 11-day Hermes mission, and 5 days of this period will be spent hooked onto the platform. According to Jorg E. Feustel Buechl, ESA's director of space transport systems, the third mission will take place in the second half of 1999, the maximum number of missions per year will be three, and the longest period spent in orbit will be 28 days.

According to Mr Buechl, the reliability of the Ariane 5-Hermes combination will remain 0.98 percent, but the security factor for the crew will be increased to 0.99 percent because of the ejectable cabin, capable of functioning at speeds of up to Mach 7 and at heights of up to 60 km.

The Hermes missions will be tested in a flight simulator to train crews and all mission control personnel, as was done with the U.S. space shuttle.

The technical side of these programs does not raise any particular problems. Europe has the scientists, laboratories, and expertise necessary to put the continent on an equal footing with the two superpowers. The only real worry is a political and financial problem: to put it simply, money will be needed, and the governments of the countries involved in ESA have to approve the funding.

08615

AUTOMOTIVE INDUSTRY

EEC's Drive Program Coordinating With Eureka, Esprit

36980008 Paris LA LETTRE EUROPEENNE DU PROGRES TECHNIQUE in French 12 Aug 87 pp 6-7

[Unattributed article: "DRIVE: Dedicated Road Infrastructure for Vehicles Safety in Europe"]

[Text] The Commission is currently devising a project which should be carried out in combination with other Community programs (ESPRIT, RACE), as well as in cooperation with non-Community programs of the EUREKA type (see list below), already under way in the fields of information technologies, broadcasting, telecommunications, and road safety.

Aim: to create modern, "intelligent" road network to -efficiently improve road traffic in Europe and reduce the number of accidents; -safeguard the environment and improve the quality of life, notably in towns.

Budget allowed: 60 million ECU

Duration: 30 months (no pilot phase)

Anticipated deadlines: -publication of the call for bids: early January 1988 -deadline for participation: during February 1988

Those concerned: -administrative and private authorities managing road infrastructures; -firms developing technologies (e.g., road information software) in connection with DRIVE which will be able to export these technologies more easily onto the world market

Fields of application: Road transport technologies and computer subsystems which involve automobiles and road infrastructure (incomplete list):

1. On-board computer system for assisted driving;

2. On-board interface technology;

3. On-board sensing technology for assessing the features of the nearby surroundings;

4. Road traffic sensing technology for road infrastructure;

5. Vehicle-to-road infrastructure and vehicle-to-vehicle data communication;

6. Vehicle identification and location technology;

7. Navigation and guidance system;

8. Traffic management technology;

9. On-board subsystem control technology;

10. Communications technology, e.g., fiber optic cables, satellites, cellular radio, infrared scanning;

11. Environmental checking system, e.g., to evaluate the condition of the road;

12. Fiber optics;

13. Image processing.

[Box, p 7]

Further Information

A meeting of the "DRIVE" working group will take place in October 1987; any interested organization is invited to participate, notably: -small- and medium-sized firms specializing in information and communications technology; -network operators and postal and telecommunications services (administrations or private firms); -national administrations involved in road safety.

Aim of the meeting: To define the outlines and nature of the participants' contribution to the DRIVE program.

[Box, p 7] EUREKA Projects in Relation to DRIVE

EU 45 PROMETHEUS: Multi-level approach to an entirely computerized automobile.

EU 55 CARMINAT: Data system for automobile surveillance and navigation.

EU 58 EUROPOLIS: Intelligent control system for urban and interurban traffic.

EU 125 DATATRAK: Computerized vehicle location system.

EU 134 ATIS: Tourist information system.

EU 133 ERTIS: European road traffic information system.

EU 145 TELE ATLAS: Electronically published geographic and cartographic databases.

EU 148 DEMETER: Computerized presentation of maps of the European territory.

25065/9738

Analysis of Management Practices, Strategy at FRG's Daimler

Interview With Assistant Chairman Niefer

369800991 Munich INDUSTRIEMAGAZIN in German Sep 87 pp 36-44

[Interview with Werner Niefer, assistant chairman of the Daimler managing board, by INDUSTRIEMAGAZIN staff]

[Excerpts] [Question] Mr Niefer, the automobile sector is the only significant source of income for this concern. This is all the more true following the company's additional purchases of AEG, Dornier, and MTU. Will the situation remain the way it is now in the future as well?

[Answer] The automobile sector is not the only significant source of income, but surely it is the most important one. Of course, nobody can give guarantees that the situation will remain so. But one thing is certain: We in the automobile sector will do our utmost to continue to build the best auto in the world. Only in this way do we create the prerequisite for the automobile sector to bring in good earnings in the future as well.

[Question] Did you ever imagine what could become of this concern if the automobile were to lose its dominant role as profitmaker?

[Answer] Of course there are factors that could adversely affect our earnings. Just take the dollar's weakness or the latent protectionism threat of the Americans. But despite these developments, I think that our product has the best qualifications for withstanding such threats. Within the Daimler-Benz managing board, we are in agreement about using for the automobile all the resources of modern technology available to us—including those of AEG, Dornier, and MTU—so that we can maintain our leading position. Accordingly I am of the opinion that the automobile will retain its role as an important earnings factor in the company.

[Question] But you have had considerable problems with the quality of your products quite recently. Is the Mercedes no longer the car that it once was?

[Answer] Granted, there have been quality shortcomings, because we had undertaken an enormous program: In order to be able to satisfy the huge demand, especially for our medium-range models, we stepped up production. At the same time we were the first and only automobile manufacturer to convert our entire gasoline-car program to standard catalyzer technology. All in all, we thus had to accomplish more than 130 launchings of new models. By now we have the situation under control. I really believe that what we are now producing is of even better quality than before.

[Question] Nevertheless, it is noteworthy that none other than the synonym for German craftsmanship had problems with quality.

[Answer] Technical progress is coming more and more rapidly and becoming more and more complicated. But we like to be measured by the highest standards. It is our philosophy that the customer with his expectations is the central consideration. Thus viewed, we had a slip- up last year. But rest assured, the Daimler star will continue to be the synonym for quality.

[Question] Then the image of quality, the basis for your success, is not shaken?

[Answer] No, we will be not only maintaining but improving both quality and image.

[Question] Then what were the important measures taken which guarantee that Daimler-Benz at present, as you say, is better than before?

[Answer] In all branches of work—that is, from the first outline of a car to its delivery—we have refined anew the interfaces and have thoroughly utilized opportunities for improvements. Quality demands our constant vigilance. Once a month, on Saturday, I have the entire leadership team meet together here in order to deal with quality in its entire scope. Whether they take up testing methods in production, the development of product details, or the qualifications of our employees, in these sessions we discuss the subject in all its particulars. Gottlieb Daimler once said: The best or nothing. That is and remains our guiding principle, and it is in that way we are also marching forward.

[Question] Recently you have also come under pressure from competitors. Mr von Kuenheim, the managing board chairman of BMW, declared not long ago that at present the new 7 series is definitely determining what is happening on the market in the upper class range. How much trouble is the new 7 series giving you?

[Answer] Here one must think in terms of relatively long periods of time. Each new car, if it cuts a good figure, generates a shock wave in front of it. That is true also of our new coupe, the C 124. Just 4 weeks after its introduction we had an order backlog of 10,000 vehicles, and today we are at more than 30,000. There is no question at all that every competitor feels the effects when a new car comes on the market. The leading position of our S-class with its degree of technical perfection and its variety of types is retaining its status and its acceptance. And when in the autumn we bring out our drive- slippage control ASR, then in that area there will be an even further push, not to mention what we still have in the pipeline. There, of course—I just want to say this in passing—we could be awfully embarrassing to overly self-confident competitors.

[Question] Will you also bring out a 12-cylinder engine?

[Answer] We have one.

[Question] When will you bring it on the market?

[Answer] When we deem it to be the right time.

[Question] Can you be more exact?

[Answer] I could, but I would prefer not to.

[Question] But we would like to have precise information.

[Answer] You have come to me somewhat too early for more precise information on the 12-cylinder engine. After all, I cannot now reveal something that is of burning interest to our competitors.

[Question] Not only BMW and Jaguar are on the attack; the Japanese as well are advancing into the top class.

[Answer] That is a logical process. The Japanese are being assailed by the Koreans and therefore are veering upwards. In terms of competition, without a doubt something is in store for the European manufacturers here. However, by now the Japanese have to cope with problems similar to ours. The yen is strong and considerably affects their international competitiveness. And also on the personnel-costs side, the march of developments has not exactly been to our disadvantage. All this does not exactly improve the offensive position of the Japanese manufacturers in Europe. And finally, the path to the upper class of cars is a thorny one. Even many a German manufacturer has experienced this.

[Question] Then at Daimler-Benz there is no fear of the danger from the Far East?

[Answer] I would not put it that way. We are taking the Japanese very seriously, because they have truly achieved outstanding things—above all when one reflects how they began. Some 20 years ago, in Europe they were still standing around with camera, pad, and pencil and copying enough to make the devil shudder. Nevertheless I have unconditionally great respect for their achievement today. But that need not mean that they are going to be so successful right off the bat in all market segments as they are with smaller models.

[Question] In any case, the Japanese have sounded the attack. And when one perceives the determination of the Far-East attacker, it may be out of place to be placid.

[Answer] It is quite certain that the Japanese have successes on the European market with their medium-range cars. But they are still quite a long distance away from the technological level of German automobile manufacturing in its full scope.

[Question] How do you interpret the event that Daimler-Benz has now been outranked for the first time by Honda on the American satisfaction scale Customer Satisfaction Index? The industry journal AUTO, MOTOR AND SPORT commented that "Made in Germany" is in danger of falling into the shadows of the stamp of quality "Made in Japan."

[Answer] You are right in saying "for the first time." But one must look at the leading position over a number of years. In this particular case, two defects were chalked up against us. The one was the air conditioning system in the 190 car and the other was the radio. On that I can only say: This is a challenge to us. And I can assure you that we have quite energetically gone to work on these things.

[Question] Then you will again be No. 1 next time?

[Answer] I would not like to be presumptuous, but our efforts naturally are going in this direction. On the basis of the most recent independent polls, we are already again at the top in the United States.

[Question] You have obviously become more cautious in your promises and announcements. Is one reason for this possibly also that you have not been able to bring onto the market at the promised time everything that you were offering to the customers as plums, for example the drive-slippage control ASR or the four-wheel drive, 4matic?

[Answer] That is not true. We are currently delivering both S-class vehicles and also middle-range cars with 4matic.

[Question] Since when?

[Answer] Since the beginning of May. I said to my people here in this division that the 4matic must be available by the time the gentlemen from INDUSTRIEMAGAZIN come.

[Question] Evidently one must set himself such targets.

[Answer] Granted, we had problems with the 4matic, because this four- wheel drive concept makes extremely great technological demands. Now of course we could have delivered the autos nevertheless, because this drive was in fact ready. But when we determined that some details were not in line with our ideas of quality, I banned its sale. And this takes a hell of a lot more courage than simply to deliver the cars.

[Question] Then where did the special problems lie?

[Answer] The problem was the transmission case, which cannot be cast in one piece. Therefore in addition a ring of aluminum must be incorporated very precisely, in order to complete the cast-iron casing. This was not so simple to do. But by using an electron-beam technology from MTU, we have done this to our satisfaction.

[Question] But do not your customers still have to wait for ASR?

[Answer] We will be supplying the drive-slippage control, which we developed together with Bosch, from September on.

[Question] But BMW is already on the market with its anti-slip assembly ASC.

[Answer] That is not comparable.

[Question] Where does the difference lie?

[Answer] In contrast to all other propulsion aids, our ASR activates electronically the brake of the respectively spinning wheel and at the same time it exerts an effect on the engine torque.

[Question] The customers are reacting otherwise here. They are saying that BMW has an anti-slippage control, whereas Daimler is still puttering around.

[Answer] I will give you a clear answer: In a few years, others also will be incorporating such sophisticated solutions.

[Question] The delays are therefore due to the fact that you have taken on too much too quickly?

[Answer] Let me say it quite simply. We have set the crossbar very high and have said to ourselves: We will make our jump at 2.05 meters and not at 1.90 meters, and then in the training the bar has fallen a few times.

[Question] And now you are training so that you can make the 2.05 meters?

[Answer] In any case we are not setting the bar any lower. If we were to be able to jump only at 2.04 meters, we would not be satisfied. Only when our target is achieved will we release ASR.

[Question] And what new high jumps have you resolved to still make?

[Answer] In the years that still remain to me as a Daimler man I will continue to be guided by the measuring rod that our forefathers have put up. That is, in plain words: Continue to build the best auto in the world.

[Question] But that is a very defensive attitude, because according to your understanding you need only to defend this position.

[Answer] On the contrary, we will be pretty aggressive, because we want to remain No. 1.

[Question] Does that mean that you want to expand the present three series of models?

[Answer] By no means.

[Question] But surely you are also planning on a car below the compact class?

[Answer] No.

[Question] What is there to be seriously said against that?

[Answer] Our philosophy—we want to build cars exclusively.

[Question] Then the things being heard about the mini-Mercedes are sheer speculation?

[Answer] In the foreseeable future we will not be involved with any car smaller than the 190 model.

[Question] And what is happening at the top floor?

[Answer] Quite a lot. The current S-class will have a successor in the foreseeable future. The same is true also for our SL generation.

[Question] Are you having to move up the introduction date for the new S-class because of sharpened competition?

[Answer] No, every new model by us is qualitatively and technically an automobile that always brings us a large lead over our competitors.

[Question] But with your divisionalized organization you surely would have to have been able to react much more quickly to new challenges recently, such as the 7-series models of BMW?

[Answer] But that simply does not mean that because of this we must move ahead the date of the new S-class. And we do not want to do this. But it is correct that the automobile sector becomes more powerful in the organizational form of a division, although previously it was already very good. I have hopes for improvements mainly at the interfaces and in connection with the materialization of innovations. If we make progress on these points, then we have achieved much.

Court of Last Resort Is the General Managing Board

[Question] It seems to us much more interesting that as head of the automobile division you are now also responsible for earnings for your sector.

[Answer] That is true.

[Question] But then how can you be genuinely responsible for the earnings of the automobile branch when portions of your business are out of your hands altogether?

[Answer] It is clear that there is only one responsibility for earnings, and as far as this concerns automobiles it lies with me. Of course that means also that I must come to understandings with various other authorities in the company in order to achieve good earnings.

[Question] Soon you will no longer have to come to an understanding with one authority, which still assumes joint responsibility for about 50 percent of your sales. From next year on, there is no longer to be any independent material-economy department for automobiles and commercial vehicles, and then you yourself will be largely responsible for purchasing in the automobile sector.

[Answer] An organization is never made to last for eternity. Just in our practical operations we found that it is better if we annex portions of material purchasing to the divisions and place the coordination of purchasing in the financial department. In this way there will always be a strong connection between the commercial-vehicle and automobile purchasing departments, which will be the job of my colleague Liener, who in the future will be responsible for finances.

[Question] Does pricing lie with you alone?

[Answer] Yes.

[Question] But the branch agencies that sell your cars come under the central sales department, thus under Mr Hinrichs.

[Answer] That is also true.

[Question] Now if the head of the branch agency gives rebates, surely it is obvious that he must answer to Mr Hinrichs for this and not to you.

[Answer] He must answer to Mr Hinrichs and to me, and if in doubt to the general managing board. In any case he cannot pursue strategies over our heads that we do not approve of. And with a proposal for rebates he would get nowhere with us at all.

[Question] Then there are mechanisms built in that prevent the policy set by you, as head of the automobile division with responsibility for earnings, from being evaded?

[Answer] Our new structure would not function at all otherwise.

[Question] But now who is the court of last resort if there is disagreement?

[Answer] The court of last resort is always the general managing board. You must not forget that the division does not have any board of directors, so by company law the concern's managing board is always responsible here.

[Question] Then you are after all not solely responsible for earnings?

[Answer] Vis-a-vis the general managing board I am responsible for earnings, regardless of with which other company authorities I must cooperate. If I do not see eye to eye with a colleague on a matter, I will go to the managing board and say: Colleagues, all gather around the conference table; I disagree with this or that manner of approach. And then it may be that the managing board decides against me and shares the burden for any reduction in earnings.

[Question] Who at Daimler-Benz ultimately decides how a new car is to look?

[Answer] Clearly the division decides this. But of course we present this car to the general managing board, which gives its blessings to it.

[Question] And what if the general managing board has an opinion different from that of the division head?

[Answer] Naturally it can happen that a member of the managing board says: So, Mr Niefer, listen here, if I were you I would make the rear slightly different. Then it would certainly be unwise of me to say: That is entirely out of the question. I would say: We will take a look at that. And after all it is certainly conceivable that the colleague is right.

[Question] That is not the point. The question is, who has the last word in connection with the new car?

[Answer] The general managing board has the last word.

[Question] Then this is true also of capital-expenditure decisions?

[Answer] Of course.

[Question] Then it can be said: The general managing board makes all decisions relevant to company policy, with the head of the division being responsible for earnings.

[Answer] With our structure, it is simply not possible to do things in any other way.

[Question] Following the change now effected in the top leadership, do you regard this structure to be in need of correction?

[Answer] If we discover that we need to correct something, then we will correct it. In the case of purchasing powers, by now we have brought about a change.

[Question] And so far you have not yet gotten the impression that you also should have control over the branch agencies?

[Answer] The managing board and board of directors are of the opinion that we should operate with the present solution right now. And that is also my personal opinion.

Daimler in Test of Toughness

36980091 Munich INDUSTRIEMAGAZIN in German Sep 87 pp 26-36

[Excerpts] Following the shake-up at the top levels of Daimler- Benz, Edzard Reuter and his second-in-command Werner Niefer want to remedy matters. The halfhearted reorganization begun early in the year is now being brought to completion; new models are to ensure Daimler's lead over its competitors.

The meeting for the 600 executives of Daimler-Benz AG following its stocktaking press conference on 18 May seemed to be a routine matter. As in previous years, this time also the directors and department leaders expected from their chairman of the managing board Werner Breitschwerdt and their head of finances Edzard Reuter a talk about the past business year—figures and facts that could be read the next day in all the newspapers.

But unexpectedly the proceedings developed into a historical event. After his picturesque interpretation of the splendid overall numbers ("a figure from Rubens") the as-yet assistant manager urgently admonished his people to not let themselves be disconcerted by the dispute on the managing board, but "to work through as fast as possible the many routine tasks that must be attended to on the lower deck."

And almost imploringly Reuter warned against causing "chaos on the officers' bridge" through impatient questions about the future of the company.

After this philippic at the very latest, even the last doubter knew what was going on: It was the entrance of the number-one man. Reuter had virtually presented himself as the new head of Daimler.

Only three weeks later, chairman of the board of directors Alfred Herrhausen confirmed this impression. At the air show in Le Bourget the German financier revealed to the then head of the concern Breitschwerdt that he could not count on an extension of his contract. An early resignation, the board chairman unmistakably indicated, would be best for the company.

The unfortunate Daimler chief had lost his last support. Observing the proprieties, he asked Herrhausen in writing to release him from his office on 1 September "for personal reasons."

The rest was a formality. In an extraordinary session on 22 July, the board of directors chose Reuter to be the chairman of the managing board, and the second strong man on the managing board, head of the automobile sector Werner Niefer, to be his assistant.

In the same washing-up action, Daimler's chief supervisor also determined the next generation of leadership. With the appointing of Conti chief Helmut Werner (50) to the automobile managing board from January 1988 on and the two highly-qualified junior managers Juergen Hubbert (48) and Juergen Schrempp (43) to be assistant members of the managing board for the sectors of automobiles and commercial vessels respectively, he established the right of succession to the two 59-year- old top executives: Werner is to be heir to Reuter in 1993 as chairman of the managing board, Hubbert heir to automobile chief Niefer, and Schrempp heir to the newly chosen automobile leader Werner.

Divisions Given Purchasing Powers

At the same time, the financier considerably upgraded the status of the two strategists of the concern: Niefer was given the responsibility for the most important Daimler business, the automobile sector. His partner Reuter advanced to be chief of the newly installed Structure and Synergy Committee. With that he would preside over the division chiefs and would report directly to the chairman of the board of directors—quite clearly a structure designed to bypass the chairman of the managing board, tailor-made exclusively for Reuter.

Following the change in leadership, Herrhausen and Reuter can now arrange the organization in such a way as should have been inevitable from the very beginning.

First of all the department of material economy, formerly independent but superfluous after the partial divisionalization, is abolished and its functions are annexed largely to the automobile and commercial vehicles sectors. In the future, the divisions alone are to decide when, where, and what is bought. A unifying function will be provided at best by the new finance chief Gerhard Liener, who outwardly will be responsible for purchasing and who is supposed to achieve higher discounts from exactly the same suppliers for automobiles and commercial vehicles.

By this decision, the responsibility for net profits of these two branches that was introduced in January of this year is now so vested with powers that they can in fact be responsible for earnings. After all, about 50 percent of the sales in the two divisions is allotted for purchasing.

Although just installed, the Capital Expenditures Committee and the Committee for Production Regulation (leadership in each case by technology manager Rudolf Hoernig) are also being abolished. The two bodies were to coordinate respectively the planning and capital-expenditure policies of the branches and draw up proposals for the general managing board on which decisions were called for—a task that in the future the top management itself wants to discharge.

For the time being the Structure and Synergy Committee is to remain, but in an altered form. Thus, at the monthly sessions not only will the division chiefs and the technology manager now have a say, but also their other department colleagues Manfred Gentz (personnel), Hans- Juergen Hinrichs (sales), and Gerhard Liener (finances).

Such meetings of the managing board under a different banner make sense only for a transitional phase. As soon as the department heads have familiarized themselves with their subject-matter, it is planned that in a second phase the structural questions will be detached from this committee and be transferred to the general managing board. Then the body, under the leadership of technology chief Hoernig, diminishes to a clearing office whose function is to probe the technical synergies among the divisions.

On the other hand, Reuter wants to keep the commissions for commercial- vehicle management planning (KUN) and for automobile management planning (KUP), which are headed by the concern's planning chief. These directors' bodies under the managing board provide for coordination between their divisions and the management services departments. Their recommendations are the basis for decisions by the managing board on the respective branches concerned (see graphic)

The goal of the new reorganization: All the contortions made in order to give Reuter the central decision-making powers in addition to the powers of managing-board chairman can now be corrected. The leadership of the company again lies with the chief alone.

At the same time, with the appointment of Niefer to be the assistant chairman of the managing board the automobile department is given prominence vis-a-vis the other divisions—not only a comment on the competence of this man of action who is constantly under high pressure, but even more an acknowledgement of the prominent role of this sector as a source of money. With just under 50 percent of the concern's sales, this branch generates an impressive 90 percent of Daimler's profits.

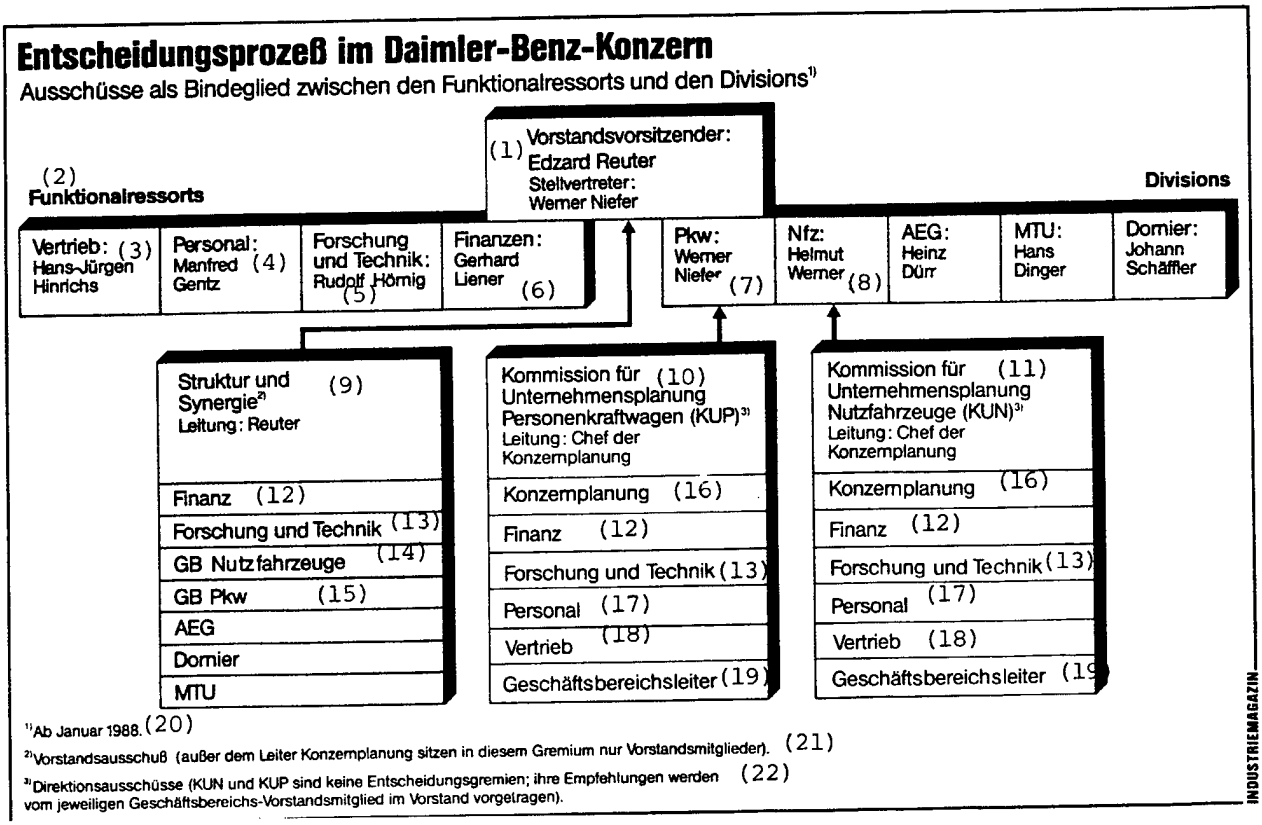
Accordingly Niefer is being given a key role to play in the buildup of this technological concern. He has to see to it that in the future as well the Mercedes limousines will continue to bring respectable additional profits into the coffers, from which are financed the requisite future capital expenditures, amounting to billions of marks, for the new appendages AEG, Dornier, and MTU, but also for the severely ailing truck sector.

Without Herrhausen's shake-up, that aspect could easily have taken a nasty turn. Because for lack of firm leadership and due to spectacular failures, the company was on the verge of endangering a reputation that is surely unique in the world. The star as a synonym for classic German craftsmanship, for maximum in soundness, for a strong financial position and a radiant company image, has quite recently waned alarmingly because of unnecessary flops.

As if its other problems were not enough, currently the star is being harried more than ever before by its competitors. The British exclusive automaker Jaguar made up ground right off the bat with its new top model introduced in 1986, and it surprisingly penetrated into the customer group of buyers of S-class cars. That is, in contrast to before the British luxury limousines are now qualitatively well finished and therefore also in demand among traditional Mercedes customers.

But more even than Jaguar, currently its arch-rival from Munich is causing trouble for Daimler. With the new 7-series introduced last autumn, BMW reported its return into the top class with a vengeance. Whereas in its best year of 1978 just 32,000 vehicles of the old 7- series were sold, this year BMW chief Eberhard von Kuenheim intends to sell as many as 45,000 upper-class cars, and next year even 50,000. With the recent offering of the new BMW 750iL, a 12-cylinder 300- horsepower engine, BMW finally stormed past Daimler and "now lays claim to top place in the automobile hierarchy internationally" (von Kuenheim).

The attacks from England and Bavaria are responsible above all for the fact that from January to May the incoming orders for the Swabian S- class limousines declined by 9.4 percent with respect to the comparable



Decision-making Process in the Daimler-Benz Concern— Committees as a Link Between the Management Services Departments and the Divisions[1)]

Key:

1. Chairman of managing board: Edzard Reuter; assistant: Werner Niefer
2. Management services departments
3. Sales: Hans-Juergen Hinrichs
4. Personnel: Manfred Gentz
5. Research and Technology: Rudolf Hoernig
6. Finances: Gerhard Liener
7. Automobiles: Werner Niefer
8. Commercial vehicles: Helmut Werner
9. Structure and Synergy[2)] Head: Reuter
10. Commission for Management Planning, Automobiles (KUP)[3)] Head: Chief of concern planning
11. Commission for Management Planning, Commercial Vehicles (KUN)[3)] Head: Chief of concern planning
12. Finance
13. Research and technology
14. Sphere of commercial vehicles
15. Sphere of automobiles
16. Concern planning
17. Personnel
18. Sales
19. Division head
20. [1)]From January 1988 on
21. [2)]Managing board committee (besides the head of concern planning, only members of the managing board sit on this body)
22. [3)]Steering committees (KUN and KUP are not decision- making bodies; their recommendations are presented by the relevant divisional managing board member to the managing board)

period last year, to 35,812 orders. The order backlog sank by 13.4 percent to 83,690 units, and by no less than 53.1 percent for domestic orders, to 9,683 units.

There is no doubt: Niefer's start as the all-powerful automobile chief does not exactly stand under a lucky star. He is showing himself to be all the more determined to challenge the competition and to have his company again move up to be the irrefutable No. 1 in the market technologically.

He was scarcely in office when first of all he quieted things down on the image-damaging quality front. The prerequisites for improving this image were favorable, especially since "we surely have not forgotten how to produce quality" (Niefer). Rather—his future second-in-command Hubbert chimed in—Daimler had "allowed itself to be diverted from its tried-and-true course by the hectic pace of the market."

In fact, last year the Stuttgart people, in a true strongman act—and despite an enormous increase in the number of units by 60,000 cars— carried out 136 new series launchings and are thereby today the only German manufacturer to have converted its entire automobile line to catalyzer models. A chastened Hubbert: "We will never do that sort of thing again."

Because Daimler-Benz has had to spend about DM 300 million so far in order to bring the vehicles that were flops again up to the customary standard in terms of design and in production, and to once again make amends to the customers affected. The guarantee and accommodation payments, which run at about a constant level each year, shot up by a good 12 percent.

Therefore now Niefer's motto is in order: "We will no longer let our launching dates be dictated by the market; the degree of readiness has definite priority."

To avoid any more repetitions of similar slip-ups, the automobile chief sits down for an entire Saturday once a month with the directors from the plants, sales, the development department, and customer service, in order to discuss exclusively how to make improvements in quality. Without regard for departmental boundaries, Niefer decides immediately and unbureaucratically who must do what, and he routinely demands control reports. If a problem seems insoluble, he sends for the vehicle and he himself thinks up a solution.

Night and day, observed general works council chairman Herbert Lucy, Niefer "like a man possessed" has been striving to get the upper hand of "the situation." "We had to slow him down, because he was demanding everything of his people and was making excessive claims on their time," according to the employees' representative.

Lucy attributes Niefer's rapid success above all to his ability to motivate his people, regardless of whether they are executives or employees. He says that after all this man comes from a background of on-the-job experience: "He knows what he is talking about."

Niefer himself makes reference to the new organizational structure in the concern. As a division chief, he can implement decisions more quickly, he says. After all, positioned around his chief workroom are the offices of the four automobile-sector leaders: Wolfgang Peter (development), Adolf-Heinz Fritz (commercial questions), Klaus-Dieter Voehringer (production), and Eberhard Herzog (sales). At the press of a button, they are always at the door.

The quality issue seems to have blown over. Not only for Niefer & Co. but also for Eberhard Russ, owner of the firm Autohaus Karl Russ in Nuertingen, and as spokesman for the Daimler-Benz representatives' committee one of the first and most uncompromising critics of the shortcomings that had surfaced. "Today the Mercedes is better than ever before," assesses the car salesman, by now satisfied.

But with his strongman act to restore quality, Niefer has just reestablished the old status. In order to also catch up with the competitors, he must also be successful with an entire range of innovations.

As a response to the 300-horsepower BMW 750i the automobile captain will already be equipping the 560 SEL (in the catalyzer version, presently 242 horsepower) with 300 horsepower for the International Automobile Exhibition (IAA) in September in Frankfurt. A new superelectronic ignition system, a higher compression, as well as two catalyzers with larger cross sections are to put on the roads the desired increase in performance. "We will not allow," says Hubbert in justification of this step, "someone else to assume the technical leadership."

Then one after the other Niefer and his troops will drive to the market improved or new models every 6 months:

1. For the Geneva automobile salon in the spring of 1988, the 190-E 16- valve car with its cubic capacity enlarged to 2.5 liters;

2. in the fall of 1988, the entire 190 series with a facelifted exterior and improved interior, as well as the 190 D as a 2.5-liter five-cylinder turbodiesel;

3. for the end of 1988, the new Roadsters 300 SL and 500 SL (see the prototype photo)—a top model with all the technical refinements such as automatically extending roll bar and detachable hardtop, at a cool price of between DM 80,000 and DM 150,000;

4. for the Geneva salon in the spring of 1989, the quarter-valve technology for the 300 E (six cylinder) and 500 SE (eight cylinder);

5. in the summer of 1989, a series of cross-country vehicles (3-liter engine for the six cylinder) which will be completely revised in design and enhanced in performance;

6. finally, in the summer of 1990 the new S-class, which "like its predecessor model will revolutionize once again the auto world" (Hubbert).

With several internationally unique technical innovations at once in the new S-class, Niefer is trying to again show the tail lights to its assailing competitors. Rear-wheel steering is to carry cornering ability to the limit; after the car starts moving exterior door handles will automatically retract into the car body and thus improve the aerodynamics; finally, a more comfortable rubber-air cushioning will permit multi-step leveling.

It is also clear that this posh car will likewise be outfitted with a 12-cylinder engine. Then a larger cubic capacity than in the 5-liter BMW V12 and a multivalve technology typical of Daimler makes it definitely likely that it will have more than 300 horsepower.

Goal is a Holding Company on the Veba Pattern

Meanwhile, Niefer's designers are even tinkering with a new edition of the legendary Mercedes 600. But this super-limousine, conceived as a prestige coach for magnates, monarchs, or ministers, cannot be on the market before 1992.

On the other hand, the mini-Benz already announced by some auto journals, a vehicle below the compact class with the in-house designation W 301, will probably remain on the shelf. After all, at present the Stuttgart people already have to sell at least ten 190's to make about the same profit as with only one S-class model. With an even smaller jalopy, not only would the earnings gap widen even further but also Daimler would have to face ruinous competition from the upgraded Japanese vehicles.

Concentrating on the existing three model series and making improvements to these do not allow any noteworthy increases in volume within the next 5 years (see graphic). Increases in unit numbers of 60,000 vehicles, as happened in the last 2 years, are to continue to be the exception. In the future, Daimler wants to have rolling off the assembly lines at most about 15,000 units more annually.

Even the planned construction of the Rastatt plant is not primarily for the purpose of increasing the number of units, although the factory is designed to build 100,000 cars. This new plant construction is necessary for Niefer because the qualitative growth aspired to requires additional production area. Increasing special requests by the customers, such as for the anti-jamming system ABS, the drive-slippage control ASR, the safety-belt tightener, the four-wheel drive concept 4matic, or the airbag safety assembly, require more employees per car and thus more space.

But Niefer's mammoth program will remain incomplete if Daimler does not strive for a better friendliness in after-sales servicing. Arrogant service personnel, know-it-all master mechanics, inflated bills, and long waits before repair work is taken on are increasingly putting off Mercedes customers, who almost always are quite well-off. "With these people, one always has the feeling," complains a sorely tested Daimler customer, "that they are performing a charitable deed."

In other respects as well the 39 company-owned branch agencies have a good many quirks. "After the Bundesbahn," scoffs a corporate identity expert engaged for the Stuttgart people, "Daimler-Benz has the most barrier gates in Germany."

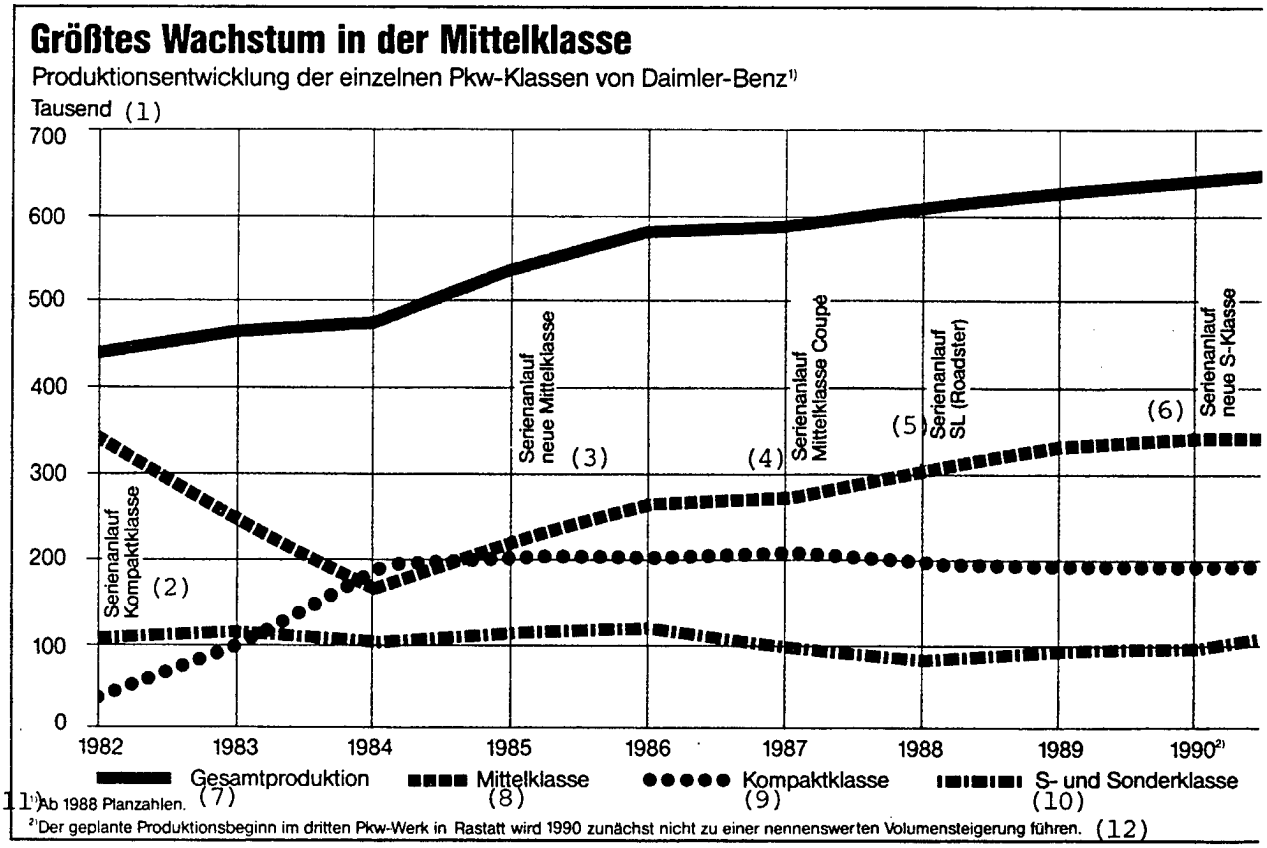
But Niefer alone cannot get anywhere with the branch agencies. They come under his managing board colleague Hans-Juergen Hinrichs, who as the concern's head of sales is responsible for customer service in the automobile and commercial vehicle sectors.

This arrangement may yet be cleared up in connection with the transitional phase from a functionally organized auto company to divisionalized technology concern. In 5 years at the latest, insiders estimate, the central sales department is likely to suffer the same fate as the material economy department has already experienced.

Then only two members from management services departments will still sit on the managing board: Manfred Gentz, because legislation stipulates as mandatory the presence of the personnel manager, and Gerhard Liener, because including the finance department "is simply compelling" (Herrhausen).

Therefore the Daimler bosses are already pondering over a new structure for the concern, which in the opinion of the majority on the managing board is inevitable: A holding-company solution on the model of Veba AG of Duesseldorf.

Just recently Veba chief Rudolf von Bennigsen-Foerder gave a report, at Daimler headquarters in Stuttgart before an illustrious audience, on the advantages of his model—which was favorably received. "Reuter's successor Helmut Werner," said a participant of the round of talks confidently, "will be Daimler's first holding-company chief."



Greatest Growth in the Medium Class—Production Developments in the Individual Automobile Classes of Daimler-Benz[1]

Key:

1. Thousands
2. Quantity-production startup, compact class
3. Quantity-production startup, new medium class
4. Quantity-production startup, medium class coupe
5. Quantity-production startup, SL (roadster)
6. Quantity-production startup, new S-class
7. Total production
8. Medium class
9. Compact class
10. S- and special class
11. [1]From 1988 on, planned figures
12. [2]The planned beginning of production in 1990 at the third automobile plant in Rastatt will not initially lead to any noteworthy increase in volume

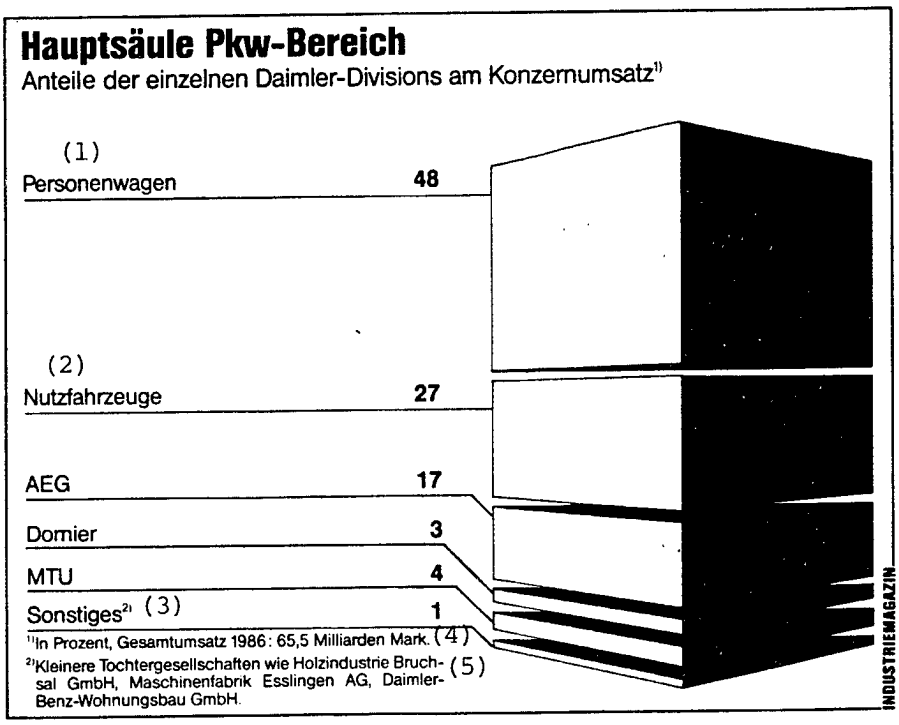
Photo Captions

1. p. 27 The chemistry is right between Daimler chief Reuter (left) and his assistant Niefer. The two have created Germany's largest concern (DM 65 billion in sales, 320,000 workers) through buy-ups of AEG, Dornier, and MTU.

2. p. 31 After the resignation of Daimler chief Werner Breitschwerdt, board of directors chairman Alfred Herrhausen decisively put an end to the unfortunate situation on the captain's bridge and thus rectified a decision made by his predecessor in office, Wilfried Guth.

3. p. 32 By a series of innovations, automobile manager Niefer intends to challenge the surprisingly strong competitors Jaguar and BMW. Next year, the new roadster SL (the photo shows a disguised prototype car) is to go on the market with all the technical refinements.

4. p. 40 The divisionalized structure permits Niefer to rapidly implement decisions in the automobile sector. His four sector leaders, Voehringer, Herzog, Peter and Fritz, are located in the same building.



Automobile Sector the Main Pillar—Percentages Held by the Various Daimler Divisions in the Concern's Sales[(1)]

Key:
1. Automobiles
2. Commercial vehicles
3. Other[2)]
4. [(1)]In percent, total sales in 1986: DM 65.5 billion
5. [2)]Smaller subsidiaries such as Bruchsal GmbH wood industry, Esslingen AG engineering works, Daimler-Benz Residential Construction GmbH

12114

BIOTECHNOLOGY

British Biotech Firm in Hungarian Joint Venture

36980003 Paris CPE BULLETIN in French Jul 87 pp 10-11

[Article signed R.B.: "Growth of Cambridge Life Sciences in the Veterinary Field"]

[Text] Cambridge Life Sciences (CLS), the British biotechnology company, was founded in 1981 with a capital of 1 million pounds from 31 Venture and from the McNally Montgomery finance company. A group of investors has subsequently raised 10 million pounds.

CLS is located in the Cambridge science park with 90 employees, one-third of whom work in the commercial section. CLS quickly marketed two products: thrombine for the treatment of thromboses and a diagnostic test for paracetamol poisoning. Encouraged by this first experience, the company focused its efforts on biosensors capable of measuring blood glucose concentrations for direct use by patients or nonmedical personnel.

However, CLS has expanded over the past 4 years into the field of veterinary diagnosis with a kit to control fertility in animals. Its R&D department relies on research conducted in many public laboratories: An agreement signed with the British Ministry of Agriculture (MAFF) authorizes the commercial use of research conducted by the Government Central Veterinary Laboratories and thus facilitates development of biosensors designed to control infectious disease. Moreover, CLS concluded contracts with 14 British universities and institutions.

More recently, CLS announced the creation of a joint venture with Vepex, the commercial branch of the Hungarian Academy of Sciences, which already supplies monoclonal antibodies to the company. This agreement allows official access to work conducted in the academy's six subsidiary institutes. In exchange, Vepex will market

CLS products in some CEMA countries, in particular Czechoslovakia, and in Third World countries. Two projects are being pursued in this framework of cooperation: a test for diagnosing the presence of oxyuris and a gamma linoleic acid extraction and purification process (an acid used in the treatment of circulatory troubles). The company may also be able to negotiate such an agreement with the Soviet Union.

By acquiring AB-AG Laboratories of Littleport in 1986, CLS has clearly shown that it intends to master the production phases of tests as well, but for the moment some of these tests are handled by the veterinary division of Smith Kline.

The financial development of Cambridge Life Sciences (in pounds) can be summarized as follows:

	1985	1986
Income		
-Test sales	160,000	580,000
-Research contracts	70,000	90,000
Expenses		
-Research and development	500,000	800,000
-Operations, marketing	760,000	1,400,000

As most new biotechnology companies, CLS suffered losses in 1985 (900,000 pounds) and 1986 (1.5 million pounds). However, in view of the strong growth of the veterinary sector, Cambridge Life Sciences shold break even in 1988.

25053/9738

FRG Biotechnology Conference Views Recent Achievements, Patents

3698m089 Duesseldorf VDI NACHRICHTEN in German No 41, 9 Oct 87 p 65

[Article by Wolfgang Asche: "Biotechnology Outside the Lab: Commercial Interests Are Gaining Priority. Enzymes, Peptides, Pharmaceuticals. A Feeling for the Right Process—Researchers Demand Patent Protection for New Developments; first paragraph is VDI-N introduction]

[Excerpts] VDI-N, Hannover, 9 Oct 87—Speaking at the closing press conference of the Biotechnica'87 convention in Hannover at the end of September, Prof Joachim Klein described biotechnology as being "motivated by science." Prof Klein, who is a member of the board of this convention and is also scientific director of the Society for Biotechnology Research [GBF] in Brunswick, cited the production of pharmaceuticals as an example of one of the most recent successes in biotechnology.

Scientists are now using manipulated yeasts to produce a hepatitis-B vaccine, while t-Pa (tissue-type plasminogen activator), an enzymatic substance used to prevent coagulation, will soon be launched into the market. This product, developed by Genentech and used in cases of cardiac infarction, has already been approved by the Austrian authorities.

Biotechnology has traditionally been defined as the industrial application of biological processes occurring in living organisms. This also applies to such well known sectors as the dairy and brewing industries, because cheese making and fermentation are both processes that depend on the aid of living organisms. One of these traditional biotechnology sectors was represented for the first time at the Biotechnica convention. Established in 1982, the Carlbiotech company in Copenhagen is involved in the application of processes observed in the research labs of the Carlsberg brewery.

The creation of Carlbiotech was triggered by the discovery that peptides, the amino acid chains in proteins, can be split not only with the aid of enzymes but can also be generated.

To generate a peptide, Carlbiotech requires only a few reaction chambers arranged in series in which selected enzymes link a particular amino acid or group of amino acids to the existing chain. Carlbiotech can provide its customers with the required know-how, while orders for supplies of peptides can be fulfilled at short notice.

The two major steps in the process—isolation and purification—are carried out with the aid of preparatory high-pressure liquid chromatography (HPLC). Compared to automatic peptide synthesis processes, in which amino acids are linked step-by-step in a reaction chamber, the enzyme method requires fewer chemicals. A further advantage over other protein or peptide synthesis processes is the fact that the end product always has the correct 3-dimensional structure, essential if it is to be applied effectively.

Sheepshearing With Peptides

Carlbiotech's Australian subsidiary, Peptech, located near Sydney, has developed a commercially interesting peptide: an epidermal growth factor for sheep. The animals are injected with this peptide, which affects the roots of the hair in the epidermis. This loosens the wool, which can then be removed by hand or "with a vacuum cleaner," as one Carlbiotech representative joked. The new wool grows back again as normal, with consequent cost savings for the sheepshearer.

Hybridoma Cells Incubate Immunoglobines

As long as biotechnology is motivated by science, this sector is increasingly subject to financial and economic interests. Firms trying to protect their biotechnology achievements from the competition are faced with a

"chaotic" situation in connection with patents, claimed Professor Klein at the closing press conference. Experts from patent authorities and legal consultants took part in a workshop to discuss various aspects of the situation. In general, biotechnology products can be protected by patent if they can be classified under the headings: "invention," "new product," or "functional value."

For instance, the mere discovery that a certain fungus can generate a useable metabolic product does not qualify for a patent. The applicant must also be prepared to accept a restriction on his claims. Genentech's patent application for their anticoagulant t-PA, for instance, was recently rejected in Britain after a trial that lasted for several days. The Wellcome pharmaceuticals company had objected to Genentech's claim to a patent for "all processes for the production of t-PA with genetically manipulated micro-organisms." The judges rejected this claim though they at the same time acknowledged that Genentech was the first to define the structure of the t-PA peptide and should, therefore, receive some "reward." However, they agreed that Genentech could not be granted a monopoly because this would obstruct the possible discovery of other t-PA manufacturing methods.

Who exactly should be allowed to make "copies" of the micro-organism strains filed with the Patents Office was one of the themes discussed at the Biotechnica workshop. Should the competition be allowed access or should this be reserved solely for independent experts? Another point discussed was the question of new products. According to the current legislation, an invention is disqualified from receiving a patent if it has already been made public, whether in the form of an article in a technical journal or as a congress lecture. Many scientists would welcome the introduction of a longer grace period for innovations.

The idea of Biotechnica as a convention, as conceived by the FRG Trade Fair and Exhibition Corporation, was achieved by the combination of workshop, congress, and exhibition. Visitors had numerous opportunities to exchange information and to meet new business associates. The next Biotechnica is already planned for September 1988.

08706

EC Commission Requests Additional Funds for Biotechnology Program

3698m152 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 468, 27 Nov 87 p 8

[Text] The EC Commission has now called on the 12 member states to increase the budget for the community research program for the years 1985 through 1989 by a further 20 million ECU ([the current budget is] 55 million ECU. 1 ECU = DM 2.07). The additional funds are to be spent primarily for biotechnology research to allow Spain and Portugal to participate in current projects.

In the Commission's view, the community must strive to train experts and use computer technology if it wants to remain competitive in the biotechnology. Furthermore, special safety precautions are required for this new industrial field.

At present, [the Commission] intends to subsidize the installation of computer systems. Among other things, this includes databanks [containing] information on genetic engineering and computer-aided genetic engineering. The 12 member states are to make an additional 4.3 million ECU available for this field.

The uncontrolled use of biotechnology in agriculture can jeopardize human health and the environment. In the EC Commission's view, the member states should first of all jointly examine the possible effects of using genetic engineering in agriculture. The results of this research could then be used as the basis for European safety directives. The Commission indicates that 4.4 million ECU are necessary for this.

The rest of the 20 million ECU estimated by Brussels should enable Spanish and Portuguese institutions to participate in the EEC research projects that were started before the two Iberian countries joined [the Community]. The Commission also expressed its approval of improved information for European enterprises about the results [of EEC projects]. Preparatory work is already fully under way for the next biotechnology research program for the years 1990 through 1994.

08702

DEFENSE INDUSTRIES

New Italian Regulations Governing Arms Exports Reported

3528m107 Rome GAZZETTA UFFICIALE DELLA REPUBBLICA ITALIANA in Italian No 255, 31 Oct 87 pp 37-38

[Text of decree No 444 of 19 October 1987 issued by the Ministry of Foreign Trade, specifying the regulations concerning transportation and shipping procedures for arms exports]

[Text] The Ministry of Foreign Trade, in cooperation with the Ministry of Finance,

In accordance with:

Provisional decree no 12 of 16 January 1946 concerning the powers of the Ministry of Foreign Trade;

Bill no 476 of 6 June 1956, amended, with modifications, into law no 786 of 25 July 1956, concerning new foreign exchange regulations and the establishment of a free market for government and foreign banknotes;

Article 36 of the treaty instituting the European Economic Community, ratified by law no 1203 of 14 October 1957;

The consolidation act of the legislative measures concerning customs activity approved by decree no 43 of the President of the Republic on 23 January 1973;

Ministerial decree of 4 December 1986, published in the Official Gazzette No 284 of 6 December 1986, concerning procedures for issuing arms export and transit authorizations;

In view of the appropriateness of adopting further instruments to supply more concrete possibilities to control the effective arrival of arms material at the intended destination, to be integrated with the terms of the aforementioned ministerial decree of 4 December 1986, and pending [the passage of] legislation regulating this area;

Hereby decrees the following:

Article 1

1—With regard to authorizations for arms exports issued after the present decree has come into force, the relevant customs procedures will be subject to submission to the customs office of a declaration of responsibility at the time customs clearance is requested and attached to the documents required under the existing legislation. This declaration is to specify the means of transportation selected, the intended itinerary, the final destination, and possible intermediate stops. The declaration must be signed by the same person requesting export authorization in accordance with the ministerial decree of 4 December 1986.

2—Once individual customs export procedures are completed, the customs office is to notify the Ministry of Finance of the shipment carried out; the Ministry will in turn notify the other agencies represented in the advisory body specified in article 4, subparagraph 3, of the ministerial decree of 4 December 1986, for the purpose of further controls. The shipment notification is to specify the nature, quantity, and value of the exported material, the terms of related authorizations, the country of destination, the means of transportation used, and the intended itinerary of the merchandise, with reference to customs documents and the declaration mentioned in subparagraph 1.

Article 2

1—With the approval of the advisory body mentioned in article 1, when authorizing individual and specific arms export operations, the Ministry of Foreign Trade may require advance notification to be presented at least 30 days before clearing customs by the exporter to the Ministry of Foreign Trade, the Ministry of Finance, and the customs office at which individual customs operations will be performed. The advance notification will specify the means of transportation to be used, the intended itinerary up to the final destination, and possible intermediate stops.

2—In the case mentioned in subparagraph 1, any changes in the aforementioned matters must be brought to the attention of the agencies listed and customs clearance cannot be performed prior to the 30th day following receipt of the aforementioned documents by the customs office involved in the operation.

3—After evaluating the material presented under the terms of subparagraph 1, the Ministry of Foreign Trade, after consultation with the advisory body mentioned in article 1, may request a change in the means of transportation. In the meantime, it may suspend the export authorization granted and immediately notify the Ministry of Finance, the holder of the authorization, and the customs office involved.

4—If, during customs clearance operations for export, discrepancies are found between the contents of the material required in the present article and the declaration mentioned in article 1, the customs office will suspend the aforementioned customs clearance operations and will advise the Ministry of Finance and the Ministry of Foreign Trade of said discrepancies. After consultation with the advisory body specified in article 1, the latter ministry may confirm the validity of the authorization issued or may request a change in the means of transportation, simultaneously suspending the validity of the authorization. All decisions made in this way will be communicated to the Ministry of Finance, the holder of the authorization, and the customs office involved.

Article 3

1—Any changes made to the contents of the declaration specified in article 1 after customs clearance operations are completed must be communicated immediately by the exporter to the Ministry of Foreign Trade. The exporter is responsible for obtaining the information required from the carrier or shipper involved within the established time limits.

2—The Minister for Foreign Trade will immediately communicate the information received to the other agencies represented in the advisory body specified in article 1 for the purpose of further controls.

Article 41—Failure to observe the stipulations of the present decree may result in the application of article 9 of the ministerial decree of 4 December 1986, or in the application of special precautionary measures concerning the means of transportation in any subsequent authorizations, amendments, or extensions.

Article 5

1—The present decree will be published in the Official Gazzette of the Italian government and will become law on the 15th day following its publication.

The present decree, with the appropriate government seal, will be incorporated in the official register of legislation passed by the Italian government. All persons are obliged to observe it and to ensure that it is observed.

Rome, 19 October 1987

Minister of Foreign Trade, Ruggiero

Minister of Finance, Gava

Notes

Note to article 1, subparagraph 2:

The text of article 4, subparagraph 3 of the ministerial decree of 4 December 1986 (refer to the fifth subparagraph of the premises to the decree is the following:

"3—Further investigation to be carried out in agreement with other ministries and agencies involved, and with the help of other advisory bodies if necessary, is intended to ascertain the reliability of all the documents presented and to evaluate the feasibility of the operation on the basis of economic, political, and national security considerations. Special attention will be paid to verification by the competent authorities of the effective use to which the exported material will be put by the importing country."

Note to article 4

The text of article 9 of the ministerial decree of 4 December 1986 is the following:

"Article 9—Requests for arms export and transit authorization will not be accepted from agents who have failed to observe the stipulated conditions and requirements during the execution of previous operations authorized under the terms of the present decree."

08615

FACTORY AUTOMATION, ROBOTICS

Mandelli, IBM Italia Factory Automation Joint Venture Described

3698m142 Milan INFORMATICA SETTANTA in Italian No 150, Sep 87 pp 40-42

[Article by Paolo Berti: "Research and Integration for the Factory of the Future"]

[Excerpts] Research and Development in Industrial Automation

The supply of products for automation also requires capabilities of technical and organizational innovation found in highly specialized firms like Mandelli and IBM. Factory automation is based on products with a high technological content, but is aimed at companies, primarily small and medium-sized companies and manufacturers of production equipment, which usually lack the resources needed to conduct their own research in all the areas involved in technological development. SPRING (Studies and Projects for Factory Automation Engineering, an IBM Italia-Mandelli joint venture) claims high-level expertise in product innovation, offering itself as a research and development partner in a position to add technological and commercial value to automation products. Specifically, SPRING is involved and conducts research in the following production areas: machine tools, robotics, movement, and processes.

Each of these areas involves different technological disciplines ranging from electromechanical systems to electronic and computer systems and from sensors and tactile devices to laser technologies and applications, as well as alternative production techniques such as optoelectronics, special heat processing, and others. Within this framework—and in all the areas mentioned—both advanced technologies and technologies currently being developed, such as expert systems and artificial intelligence, will coexist with existing technologies. As a result, it will be possible to manage a large quantity of data and information produced by increasingly sophisticated and complex microelectronic, mechanical, and optical component technology. Expert system applications are already available for the automatic diagnosis of programming errors, automatic maintenance, and the control of production processes. Using artificial intelligence technology, it may be possible to transfer typically human functions such as vision and voice recognition to mechanical devices, and to industrial robots in particular.

In Italy, there are other research opportunities in these areas in the [form of the] research programs directed by government bodies (such as the CNR [National Research Council] finalized projects), and at European level by the EC (ESPRIT and EUREKA) in which SPRING intends to participate.

The Italian Industrial Automation Market

Advanced technologies for factory automation (such as electronics, mechanics, computer science, and communications as a whole come under the heading of CIM (Computer Integrated Manufacturing). More than a market in its own right, CIM in fact represents the sum total of the systems and products designed for use—including independent use—in manufacturing.

The following fall under the CIM heading: —MRP (Manufacturing Resource Planning) systems for production management; software applications for managing the ordering process, for production planning, and for automatic data retrieval; [etc.] —design and engineering systems, referred to under the now familiar acronyms of CAD and CAE (Computer Aided Design and Computer Aided Engineering); —FMS (Flexible Manufacturing Systems); mechanical and electronic systems for the physical automation of the production process, such as digital control machines, robots, and AGV (Automated Guided Vehicles); [etc.] —CAM (Computer Aided Manufacturing) systems; CAPP (Computer Aided Process Planning) systems for the automatic design of manufacturing cycles; —expert systems, applications, and prototypes based on artificial intelligence technology.

It is estimated that the Italian factory automation products and components market amounted to 2.7 trillion lire at the end of 1986, surpassing the total sales of approximately 2.5 trillion lire achieved by the machine tool production sector. The latter represents 9 percent of the entire European market and approximately 20 percent of Japan's total.

According to Assinform, 3,310 robots were installed in Italian firms in 1985, representing 13.9 percent of European robot installations.

Sales of robots (by the 56 firms operating in Italy) in 1985 amounted to 128 billion lire (source: UCIMU [Italian Association of Machine Tool Manufacturers]). Sales of production management systems totaled 738 billion lire at the end of 1986 and are expected to grow at an average rate of 11 percent between now and 1991 (source: Reseau [Research and Studies in Electronics and Automation]). In 1984 FMS [Flexible Manufacturing Systems] installations in Italy (including machines, robots, and applications for flexible and automatic production) came to 10 percent of the world total (in absolute terms 32 out of a total of 327). According to Assinform forecasts, 100-150 robots should be installed by 1990.

SPRING Is Born

This is the framework within which the joint venture—51-percent owned by Mandelli and 49-percent owned by IBM—was constituted to operate in factory automation. The new company, called SPRING (Studies and Projects for Factory Automation Engineering), will operate as a technology center carrying out applied research on behalf of manufacturers of production machinery and equipment. The technologies used, which are becoming more and more complex, are increasingly difficult to integrate and require sophisticated multidisciplinary skills that today are only rarely found in small and medium-sized firms.

Thus SPRING, which brings together other IBM and Mandelli factory automation initiatives, will be able to supply various manufacturers with models and projects based on the most advanced technological prototypes to increase both the level of automation and the degree of integration of their own equipment. For example, one could request a project to modernize a product integrating advanced technological tools such as special tactile, visual, or voice processing devices.

The president of SPRING, located in Piacenza, is Franco Bernardi, assistant general manager for external affairs at IBM Italia; the vice president is Gian Carlo Mandelli, currently president of the firm of the same name. Ten members, designated by each partner, will make up the board of directors.

The new firm will be in operation by next October and will have approximately 100 employees, some of whom will come from the two shareholders. The research structures will comprise working groups set up on the basis of the orders received and appointed for the duration of the project.

This initiative based on Mandelli's experience in flexible automation and on that of IBM Italia in the computer field is aimed at the manufacturing automation market, comprising makers of machine tools, robots, measuring and testing tools, robotized warehouses, and movement systems. The machine tool sector, comprising roughly 500 firms with 29,000 employees, had 1986 sales of approximately 2.5 trillion lire.

08615

Italian Machine Tool Officials Examine Development Trends

UCIMU President Interviewed

3698m117 Milan ELETTRONICA DOMANI in Italian No 10, Oct 87 pp 22-26

[Interview with Pierluigi Streparava, president of the Italian Association of Machine Tool Manufacturers: "The Factory of the 21st Century;" first three paragraphs are ELETTRONICA DOMANI introduction]

[Excerpts] Less cast iron, more software. When you first hear this phrase, it sounds like a slogan from the postindustrial era, or an appropriate headline from a data processing magazine. Instead, it is simply a phrase adopted by Pierluigi Streparava, president of the Italian Association of Machine Tool Manufacturers [UCIMU]

to describe in just a few words the reasons and the objectives for the association's change of name to UCIMU-Production Systems.

The decision to change was made last spring by the board of directors with an amendment to the association's charter, and the change is not just symbolic. With its new name UCIMU, which is part of the Confindustria [General Federation of Italian Industrialists and Manufacturers] (165 associated companies with total sector sales of over 2.5 trillion lire in 1986), is aiming to expand its sphere of operation and consolidate its organization.

The association's "new deal" is just at its initial stages, explains Pierluigi Streparava, owner of Streparava S.p.A. of Adro, near Brescia, (established in 1951 and specializing in mechanical processing for industrial vehicles, machine tools of various types and sizes, and steel molding; with 300 employees, 1986 sales of 39 billion lire and an industrial plant which covers 20,000 square meters).

[Question] What were the reasons for changing the traditional association to the new UCIMU-Production Systems and how would you describe the new organization?

[Answer] The gradual move in the direction of robotics started just over 2 years ago. The origin is easy to identify and understand: in the mid-1980's the production and market situation of the machine tool sector was changing rapidly. UCIMU tried—I believe successfully—to deal with this change swiftly and to adapt its organization, identity, and very style of operation, taking advantage of the experience of similar European associations such as France's SFCMU, which became SFCMU-Robots and Automation.

[Question] What changes have occurred in the machine tools sector?

[Answer] The most significant change is that, as opposed to the situation in the recent past, electronic components have become the predominant tool in the design and manufacture of production tools, working together with the original mechanical components.

In brief, the majority of users have either made or are making the decisive quantum leap from the machine to the system. The suppliers that we represent have adapted their services to this new demand.

[Question] UCIMU has also adapted itself to the new situation; what are its objectives now that it has changed its style?

[Answer] There are two basic objectives. First, and most important, we are a point of reference for our associates, and as such we have to provide continuity concerning technological changes within the production strucutre; and second, [we aim to] expand our organization, which is made up of both ordinary members and members authorized to manufacture their own products under the UCIMU trademark (a sort of quality assurance available to companies with over 3 years' membership, which work on original programs, and which can prove positive financial results for at least a 3-year period).

[Question] Your decision has, however, shocked and created tension within ANIE [Association of Electrical Engineering and Electronics Companies] which, like UCIMU-Production Systems, belongs to the Confindustria. What is your opinion concerning ANIE's reaction? And how do you justify, from the association's point of view, your new identity, since some people have already accused you of being an unwelcome intruder in the sector?

[Answer] This is true; some people were really upset. But we believe we have acted fairly, bearing in mind the changes that have occurred in the machine tools sector lately. While 5 years ago our expansion could have seemed excessive, today it can be seen simply as a natural evolution. However, our charter permits [simultaneous] membership in both UCIMU and ANIE.

As for our relationship with the Confindustria, we ensure that each member company adheres both to the vertical structure (UCIMU) and to the horizontal structure (Confindustria, via local organizations).

[Question] As we have said before, UCIMU's new structure heralds the change from the machine to the system. Does this mean that the next step is the automated factory?

[Answer] In Italy, in terms of both the quality of design and production, and the application at an industrial level, the concept of factory automation is limited at present (that is, the concept of a group of machines for the production of goods or equipment, connected and controlled by a single, comprehensive computer). There is a very simple reason for this. The automatic factory is like a Formula 1 car: once conceived only a few, very expensive models are constructed, which then become unique, priceless objects exclusive to the larger industrial groups.

However, in my opinion it is more important to exploit factory automation technology for traditional machine tool innovation.

[Question] How can this be done?

[Answer] On the one hand, by applying the technology and experience acquired from the development of factory automation to the development of machine tools; and on the other hand, by increasing and streamlining production of the intermediate level represented by robots, manufacturing cells, and Flexible Manufacturing Systems (FMS), which constitute the link between machine tools and the automated factory.

However, all this takes time, and we are only just beginning; the FMS in use in Italy today are no more than 15. The only successful automated factory in the true sense of the term can be found at the Fiat plant in Termoli (in the province of Campobasso) which makes car engines such as the "Fire" model.

[Question] By its very nature, the machine tool sector cannot be transformed or grow overnight; there are also serious obstacles (as in all the other production areas) such as the increasingly aggressive presence of the Japanese. How does UCIMU view what is unimaginatively termed "the yellow threat"?

[Answer] We are very concerned about Japanese competition, for the following two reasons: first, Japan recently reached an agreement with the United States to cut back exports to the United States, as previously happened in 1982; second, the entire Japanese market is on the decline, with a decrease of 15-20 percent in the last few months and, as a result, Europe has become the target for all manufacturers of machine tools and automated production systems from this country.

[Question] How extensive is the Japanese presence in Italy?

[Answer] Until now, Japanese penetration of the Italian market has been limited. However, last year we noted a significant increase in imports. According to our information there was a 90-percent increase over 1985, for a total value of 65 billion lire, (approximately 4 percent of the national market). This figure also includes "indirect" imports from Belgium and the UK, and an unscrupulous price policy with regard to dumping. Furthermore, until 4 years ago the Japanese only produced lathes and work centers, whereas today they are present in all areas of the sector, which is threatened on all sides.

[Question] If this is the situation, what do you as an organization expect from the government and the EC?

[Answer] A meeting of the European committee of machine tool manufacturers was held in June, and an explicit request for official intervention by the EC on the Japanese problem was drawn up and unanimously approved.

[Question] Is this an appeal for a neo-protectionist policy?

[Answer] No, although some newspapers have stated this, distorting the truth. We are simply asking for some sort of protection for the European machine tool industry, similar to that applied in other important production sectors such as the automobile industry.

[Question] So what intervention do you in fact want?

[Answer] The type of measures adopted must be decided by the competent authorities. We only highlight the facts as they stand and our requirements. It is up to the public authorities to take the necessary decisions in the most effective and timely way possible.

[Question] The Italian government has already provided a protection measure with law 212, making available 160 billion lire to small and medium-sized companies for technological innovation. What effects do you expect this funding to have on your present and potential customers?

[Answer] Since the Italian machine tool market has been at a standstill over the last few months, law 212 certainly provides fresh air to these companies. This is an indirect form of aid, aimed at stimulating demand (with grants equal to 25 percent of the total amount invested).

[Question] What are your short- and medium-term forecasts for machine tools and production systems?

[Answer] I can safely say that the second half of 1987 will confirm the trend of the previous months. Consequently, we will have little or no growth this year.

On the other hand, 1988 and 1989 should show annual growth of 5-6 percent. A lot of machinery used in Italian industry as a whole is becoming obsolete, and we are counting on the growing need to replace equipment.

[Question] The domestic market seems quite promising then; but what about foreign markets?

[Answer] At present, exports of machine tools and systems account for over 60 percent of production. It may be possible to maintain this level of exports, though [to do this] we must continue to provide high-quality products.

Machine Tool Manufacturers Interviewed

3698m117 Milan ELETTRONICA DOMANI in Italian No 10, Oct 87 pp 27-34

[Article by Manuela Piscini: "The Protagonists Have Their Say"]

[Excerpts] The road from traditional machine tools to the automated factory is long and arduous, but in some respects fascinating. The itinerary's final objective is CIM (Computer Integrated Manufacturing, that is, computer aided production), where automation is not limited to the production areas, but also involves offices and warehouses.

Today, it is more realistic to talk about production automation, leaving the issue's wider aspects to be dealt with some time in the future. Within this framework, automation of entire industrial processes is rare, whereas single cells are more common and represent the first significant step.

The change in perspective is an important fact. It is now archaic to think of single, autonomous machine tools. One should now think in terms of systems, whose equipment is integrated and coordinated both mechanically and electronically. The introduction of electronics marks a turning point, since it challenges the organization of the factory from the point of view of both manufacturers and users.

In the light of this evolution UCIMU has changed its name. By doing this, the association of machine tool manufacturers has opened its doors to the electronics industry. The new mechanical-electronic relationship is therefore one of the main topics of the day (and the increasing number of consortia being established, uniting the companies of the two sectors, is just one of these).

Berardi: The Group Leader

The region between Piacenza and Brescia is another "hot" area of the machine tool industry. It began in 1926 with a small manually controlled drill and has not stopped since. Today, the Berardi "Group" has 800 employees, and employs the help of a number of subsidiary companies in the machine tool sector: OMUS, AMP Abrasivi, Meccanica Nuvolera, Francesconi & Terenghi, Italplanning, and Ceruti.

At first, the Rino Berardi Officine Meccaniche developed its technological know-how according to customer requests. Today, the company is managed by the founder's son and daughter, and is actively involved in anticipating future demands, identifying new technologies in different fields, and applying them to its own production sector.

This explains the fact that 20 percent income from sales is invested in research, (1986 sales totaled 60 billion lire and sales of 75 billion lire are forecast for this year, with 490 employees). These figures are perfectly in line with the Berardi product which essentially consists of specialized solutions to meet specific situations.

Production ranges from CNC boring machines to FMS with various automation levels, extending the control of a number of transflex lines and a number of work and assembly groups including the control of the supply and distribution of parts, tools, and other equipment necessary to the production system—in a word, CIM.

In fact, UCIMU's change of name (UCIMU has had this name since 1947) fully reflects the experience acquired over the last 10 years. Renzo Buffoli, sales manager, says it is also true that the change has given the association a boost, and is attracting the interest of a wider range of manufacturers. However, in Italy there are no more than about 10 FMS producers.

Mechanics and electronics constitute the sector's research activity. Buffoli stresses that in order to create an automated factory, it is vital to have single machine tools appropriately designed in terms of electronics and mechanics. Another important aspect is the reliability of each machine.

Integration of the two components that make up flexible systems is not particularly difficult, according to Buffoli, since this is based on methods and experience obtained with single workstations. Today the problems cover a much wider territory, but hold no special secrets for us. Relationships with electronics companies are by definition based on interdependence and, therefore, collaboration.

How does Berardi see the future of the market? The company is optimistic, even if they stress the fact that sales trends depend on too many factors, not just on technology, and this therefore makes it more difficult to make forecasts. Of course, there are not yet enough Italian customers to take up the entire national production potential. Berardi, like other companies, must keep a watchful eye on the foreign markets, which constitute approximately 70 percent of its total sales. This impressive total, together with other data shows that Berardi is ready to challenge the most aggressive competitors.

Elsag: State-of-the-Art Research

A leader in the field of mechanics and one of the most representative is the Genoa based company Elsag-Elettronica San Giorgio (part of the Selenia-Elsag group within the IRI-STET Group). The company's 1986 sales totaled 212 billion lire, with 300 billion lire forecase for this year; the company has 1,900 employees, almost 50 percent of whom are engineers and qualified technicians.

The company operates in naval defense, and service and factory automation, with Giorgio Minucciani as general manager. Minucciani was general manager of DEA-Digital Electronic Automation which joined the group in 1983 and produces complete, high-quality, competitive automation systems. The process continued with the creation of SEIAF, ITALCAD, and PROMA, a research company for the production of manufacturing systems capable of economically manufacturing mechanical parts in small batches, including batches of different parts.

This flexible commitment has made it possible for Elsag to export its products aimed at the middle to upper end of the market, all over the world, especially to the United States.

Elsag started with numerical control systems and gradually introduced state-of-the-art systems, including control systems for entire flexible manufacturing plants and the related data processing network links.

The company's ability to coordinate its wide experience has become a success factor. Furthermore, "integration" has become the key word in Elsag's philosophy. Minucciani reminds us that the fundamental element of manufacturing process automation is constituted by the various operating units in the factory. A correct understanding of the problem will provide the right strategic decisions based on experience and objective criteria, rather than on abstract theories or random selection.

Elsag's 1987 investments in research are expected to total 31 billion lire, 10 percent of sales. The company is currently making a study of a work cycle automation system that will link the upstream design activities (CAD) with production (CAD) downstream.

Integration is also the basic concept of the experimental center being built in Genoa. The project is supported by the EC through the ESPRIT program, and includes other leading European companies in the sector. The plant will reproduce the real conditions of a flexible manufacturing factory for mechanical parts. Artificial intelligence is another area of research which is of significant interest with regard to the possible applications of factory automation.

The future of industrial automation is taking form in Elsag's laboratories.

Siemens: Integration at the Forefront

Another electronics giant specializes in integration. Stefano Stephan, manager of the automation sector, stresses that automation must have the requisites to provide easy communication between single machines. In other words, the equipment which is part of the automated factory must be able to interconnect the mechanical and, above all, electronic components.

With this in mind, Siemens (600 employees, estimated 1986-7 sales of 150 billion lire) welcomes the addition [of the words] "Production Systems" to UCIMU's name. Siemens sees this as an adaptation to the initiatives already taken by the companies of the sector to provide their customers with integrated machine tools.

However, it is important for the exchange of technology and experience between mechanics and electronics to be constant and productive. Stephan states that if the Italian machine tool sector manages to become the first to change from traditional to advanced production methods, it will be able to meet the challenge of future international markets.

And what about the Japanese? They will have to settle for collaboration with the most dynamic local companies, especially those in the integrated automation sector. EC protectionism would be wrong, but EC support would help to bridge the technological gap between Europe, the United States, and Japan.

ELECTRONICS ENTERS THE FACTORY

	1984	1985	1986	1987
Process control systems	31	29	28	29
Process control equipment	31	32	33	34
Process control instruments	20	20	19	17
Power equipment	18	19	20	20
Total Value (in billions of lire)	1,150	1,300	1,495	1,700

The table illustrates the Italian industrial automation market according to ANIE. The figures represent the percentages per subsector.

[Box insert p 34]

[Excerpt] Statistics show that the transportation industry is the major user of flexible manufacturing systems. In fact, the only example we have of the automated factory of the future is the Fiat plant at Termoli. The list then continues with Alfa Romeo, IVECO, Lamborghini Trattori, Maserati, Rockwell, and SAME. Ferrari produces all its engines for the Testarossa in a large shed measuring 20 x 100 meters. The building contains just one machine, a gigantic super-robot managed by a single intelligence, which produces 3,200 engines a year under the supervision of 20 employees. Before the installation of this machine (made by Mandelli), 120 blue-collar workers produced 1,500 pieces in the same period of time.

At the Nuova Innocenti plant in Milan, a multipurpose system for both motorcycles and cars produces complete engine head cylinders every 3 minutes. There are eight numerically controlled workstations, an electronic unit for direct on-line inspection of the piece, motorized conveyor belts connecting the workstations, and loading and unloading, washing, and faceplate stations. All this is controlled automatically by a central computer which programs the processing in real time.

Still in Milan, the Piaggio-Gilera company makes a complete motorcycle every 2 and 1/2 minutes. The entire process is controlled by a computer with an automatic work program distributor that collects data from each workshop.

Polymotor Italiana in Casella, Genoa, is another Elsag plant. Fifteen operating units of various kinds are connected in real time to a central computer, and 5,000 electric motors for 50 different types of home appliances are assembled and tested. The plant can operate without supervision.

08618

LASERS, SENSORS, OPTICS

German Research Society Completes Report on Rare-Gas Lasers

3698m124 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 467, 15 Nov 87 pp 9-10

[Text] Despite considerable improvements in recent years rare gas lasers, frequently used in universities, research institutes, in industry, and for medical treatment, leave much to be desired. This was proven by a survey conducted by the DFG [German Research Society] in the spring of 1987. In particular, scientists complain about the persistently short durability of plasma valves used in lasers.

As early as 1983 the DFG asked scientists to investigate the most frequent causes of damage, the construction-linked weak points, and the laser's durability. Since these questions [have arisen] the situation has basically changed. A substantial part of the difficulties outlined 4 years ago have been overcome with the introduction of metal-ceramic technology. It has been possible to satisfy science's demand for conditioning plasma valves and the resulting calculable costs. Nevertheless, as the latest investigation shows, considerable efforts remain necessary to further improve the existing systems. The frequent failure of lasers considerably hinders experimental applications despite all efforts of users.

Rare gas lasers, particularly argon and krypton ion lasers, are used for the production of radiation with high energy concentration in the visible, and sometimes even in the ultra-violet spectral field. The versatile potential applications range from spectroscopy in physical and chemical basic research to clinical applications for example in AIDS diagnostics, in the treatment of retina damages [Verschwei Bungen] to treatment of cancer of the bladder. With a total of $90 million per year, rare gas lasers represent one-sixth of [total] sales of lasers worldwide.

The results of the DFG survey have been published by the organizational committee of the DFG under the title "Experiences in the operation of rare gas lasers (II)"—VCH Verlagsgesellschaft, Weinheim. The report contains technical data of the 229 laser systems registered, notes distinctions in durability of the different types of lasers made by various producers, presents the results of an analysis of weak points and causes of damage, and contains a summary of the results reported by the users, in particular the comparison between the original and the new laser technology.

08701

SCIENCE & TECHNOLOGY POLICY

FRG Research Minister Outlines German Participation in EUREKA

3698M096 Bonn EUREKA FUER EUROPA in German 1987 pp 11-21

[Paper by FRG Research Minister Heinz Riesenhuber: "Gaining Importance Together: EUREKA—An Interim Survey and Prospects"]

[Excerpts] About 650 million ECU have been spent this year on European Community research programs. This is a considerable sum, but it does not include all European initiatives. We are working together excellently in space technology with ESA, for example, where the total spent is about 1.35 billion ECU, more than double the EEC research program. Thus, in a field where European cooperation is clearly necessary, we have organized an extraordinarily successful and comprehensive technological cooperation. This cooperation does not only come to the fore in a few spectacular projects but in a whole range of technologies that are developed in connection with these great projects, reaching far into the field of small and medium-sized businesses.

No Patented Solution for All Problems

Without going into individual details, we have very comprehensive cooperation in basic research. A part of this cooperation is integrated into the European Community, but it also arose from bilateral or multilateral agreements among states. Finally, there is the EUREKA program. Thus, in Europe we are not trying to solve every problem with a patented solution. We are much more convinced that Europe's strength will only be exerted when the various technological development initiatives support each other in sensible interplay and thus gain in importance. There is no question, as it was once asserted some time ago, that European cooperation serves a purpose exclusively in technology. We are much more of the opinion that there are fields where technological objectives can be reached faster and better with European cooperation than by trying to achieve them alone nationally. Cooperation in our continent is a sensible procedure and [does not have] a unidirectional objective only in cases where we reach a European added value in this sense. We cannot allow ourselves to decide on projects according to the value of the cooperation in itself, but in terms of rational assessment of their advantages.

Thus, every project must be tested first to see whether it can be carried out at a national level or whether it needs a European contribution. If a given project can be carried out at a national level, it should never be allowed to be completed at European level just because there is some hope of receiving additional subsidies this way. In practice, this would be a dangerous, erroneous market control, the result of which would be that the difficult processes of cross-border cooperation would also be set in motion for projects that do not need them. But this means that we would be delaying innovation, overloading enterprises with work, and not achieving a foothold in technologies and markets as quickly as we actually need them.

Helping Modern Technologies To Break Through

There is a fourth level which encompases the field that is the biggest and fastest growing in terms of projects. These are the traditional industrial projects where it is a matter of processing and transplanting as quickly as possible new knowledge that exceeds one's own company's possibilities. There are certainly questions here for which we cannot always find a sufficient technological know-how, not only in any given enterprise but often even in the entire country. This was the case with laser technology, for example. This technology is currently making incredibly fast inroads into completely different markets, basing itself on different types of lasers such as solid state lasers, CO2 lasers, and excimer lasers. It varies in different individual technologies, into which I do not want to delve at the moment. A new type of market has arisen here very quickly. On the one hand, it is a matter of knowing very quickly what lasers are available in this market; on the other, of knowing how the various lasers can be integrated in systems. In this field we can only reach the essence of technological know how by grouping together the best companies and the best scientific institutes from our country and other European countries.

Large, medium-sized, and small companies, as well as newly established enterprises, work here in a certain project together with scientific institutions. Only through this cooperation can we succeed in helping technology to break through onto the market at an early stage. In the past, we have promoted further development of CAD/CAM technology. Projects like the "Factory of the Future" go one step further in the direction of CIM technology. Here it is also a decisive matter of our having common standards from the beginning and establishing intersecting points in such a way as to enable the various different systems to grow together. This is by no means a priority of large firms. These questions are much more interesting for small and medium-sized companies if you consider not only that they play a role as CIM technology users in their own business, but that our CIM compatible machine tool construction, for example, is practically all concentrated in medium-sized companies.

Facing the Strongest Competition

Industrial projects can also be very large, like silicon submicron technology, for example. Here the decisive question is how can we succeed against our strongest competitors. It is a matter of deciding whether a chip oligopoly will reign over the markets of the 1990's, with the result that other countries will always have the latest chips to offer in their production while our companies will only get the chips when the first innovator's profit has already been worked out. If such a development occurs in the course of two or three chip generations, the world will be split between those who are still in business and others who have not been able to keep up. It will then no longer be possible to close this gap because as the first innovator's profit enables a certain measure of additional research to be carried out, which becomes increasingly inaccessible to others. This is also the reason why we attempt to promote such strategic technologies, even when they are looked upon as practically unreachable.

Old Funds for New Projects

The president of the German trade and industry conference has pointed out that there is no intention of opening new subsidy channels within EUREKA. EUREKA has no heading of its own in the BMFT [FRG Ministry for Research and Technology] budget. Contributions to EUREKA are supplied clearly from scientific program sources. Thus, we find that there is a new division of funds here in one field which I consider to have priority, as international cooperation is more difficult than working together within national boundaries. In order to overcome this threshold, I think a case can be made for providing limited financial means for a limited time.

In this context, there is good reason for hoping that these means will be limited. Industry subsidy share for the projects [approved] in London amounted to 57 percent. By comparison, in Stockholm we will have a BMFT subsidy share of about 43 percent. In this context there are individual projects with a 30 percent subsidy share. On the other hand, a growing industrial participation can be noticed, with five projects financed exclusively by industry. I hope and trust that the number of these projects will increase. The trend in the BMFT budget is quite clear: while in 1982, 57 percent of financial support still went into the economy, this figure sank to 43 percent in 1986. On the other hand, we have increased the funds available for basic research just as much as those for preventive research which, for example, is looking for solutions in the fields of health and ecology.

It should also be stated that, within this overall shrinking share for the economy, we have progressively increased subsidies for small and medium-sized companies, not only relatively but absolutely. On average, large companies receive 4.5 pfennig subsidy for every DM they spend on research, while small and medium-sized firms receive 11 to 12 pfennig. Thus, we have put a strong emphasis on

medium-sized companies. This did not happen because I intend to follow a organizational policy. The reason was much more that special need and an enormous opportunity had arisen for giving middle-sized companies an impetus for entering new markets. You can see for yourself in any trade fair that these opportunities were successfully exploited.

Partners Should Look for Each Other

Let me add a few more comments about the EUREKA structure. It is impossible for partners from business or science to be forced into cooperation, as some have demanded. The analogy with arranged marriages was drawn at an earlier EUREKA conference. In this sense we have agreed that the principle of cooperation can only exist only if those who want to work together, are allowed to work together but that in no circumstances should anyone be forced to work together with others. We have thus created a structure that can offer a great degree of flexibility.

I believe that the resulting openness can be of great assistance in creating openings in the short term in markets with rapid breakthroughs in new technologies. New developments should be able to arise without being planned in the long term; they should be a result of exchanges between partners. The idea of EURKEA is that partners look for each other, organize their own project construction and that they finally make efforts to find further partners. These partners may in some cases also be in the public sector, for example when standards or infrastructures are necessary, or also in the borderline case when a certain financial contribution may be desired.

Fast and Unbureaucratic Procedures

In this respect, I believe that EUREKA is entirely capable of bearing comparison with other European research initiatives. It is not EUREKA's intent to compete with them or even take their place. However, EUREKA can complement them in fields where fast, unbureaucratic procedures are important. And I feel that it is quite essential in this context that countries, and institutions and companies from these countries, can become partners just like the [EC] Commission itself. This is valid for the Commission with its various aspects starting from its sovereign responsibilities in the field of laws and standards to certain coordinating functions. In this context one must be somewhat reserved as the main work must be done by companies and institutes. Of course I am not excluding that the Commission may introduce financial contributions in situations where they make sense in terms of program outlines. This is certainly a question that everybody must decide for himself. The Commission has the same freedom here as every other partner and this must be taken into consideration.

On Bank Initiatives

I would like to start out [by commenting] on the thoroughly dynamic development of the FRG's venture capital market, which was still practically nonexistent in 1982. At that time only one firm worked in this field, which was subsidized by the BMFT, with a capital of about DM50 million. Now we have nearly three dozen firms with a total capital of DM800 million, financed by the markets. On the other side there are the traditional banks.

The projects that we now start within EUREKA are often settled between these two institutions. Very large projects, such as Jessi or Prometheus, which are market oriented, need billions in expenditures and thus are beyond the possibilities of a normal venture capital firm. Such a firm has other goals—it prefers to concentrate on young enterprises. On the other hand, financing such a project is also quite a different matter from the traditional banking business.

Here we only have to find a field where very large projects can be financed within the competence and with the great financial reserve of European banks. At the same time, however, it must be possible to make a technically competent judgement of potential markets. On the basis of these two elements, financing packages from private industry can then be put together that are still beyond currently existing financial markets.

Not Depending on State Subsidies

I consider this to be a fascinating opportunity, not only because I feel that fiscal restraint is necessary. It is much more important that we introduce a bearable pressure in these markets by financing with private capital. The disadvantage of state project subsidies always shows itself in [the fact] that the more market-oriented the project is, the worse it becomes; that is, the attempt to rely on state subsidies rather than acquiring money by selling the product on the market is not negligible. If, however, a project is backed by private capital that demands interest payments, this exerts a pressure that the state can never handle.

Thus, it seems to me to be an essential element of EUREKA to build a strong private business responsibility into this initiative. On the contrary, we must avoid a situation where one would be inclined to rely on government subsidies. In this context, the Stockholm conference will take another important step toward a successful EUREKA initiative. It is a matter of developing such a trend that the government only has to support, in borderline cases, individual fields. Once it has given the impulse to moving a project over the threshold, it should withdraw.

From this perspective, there is a chance that EUREKA will give an impulse toward the development of markets in compliance with Europe's scientific and technological position.

08702

FAST Program Director Outlines Long-Term Innovation

3698m065 Duesseldorf VDI NACHRICHTEN in German No 44, 30 Oct 87 p 27

[Article by Claus Reuber: "VDI/VDE Seminar Regarding the Turbulent Changes in Industry," "Europe Needs Long Term Innovation Targets," "The Knowledge Capital of Human Beings Is Decisive"; first paragraph is VDI-N introduction]

[Text] VDI-N, Berlin, 6/11/87—CHIM [Computer and Human Integrated Manufacturing] instead of CIM [Computer Integrated Manufacturing] for Europe; this is the message reduced to a modern abbreviation of a seminar concerning the EC's FAST [Forecasting and Assessment in Science and Technology] program held in Berlin on 22 October. "Computer and Human Integrated Manufacturing" is supposed to utilize the capabilities of Europeans more fully than would be possible with "Computer Integrated Manufacturing." It also emerged that Europe is becoming less competitive in key technologies like microelectronics, new materials, biotechnology, and laser technologies.

Dr Riccardo Petrella, director of the FAST program, emphasized that so far the intensified cooperative research programs have been of no help either, with the result that technologically strong countries like the FRG suffer from the overall European weakness. He requested for cooperative R&D programs to be intensified; however, it is not sufficient to measure research subsidies with technical criteria alone. Today, innovation should be oriented not so much toward short-term competition as toward long-term objectives. The availability of technology should not ignore the specific users' requests, but should rather consider them.

To him, as to Klaus P. Friebe, manager of the VDI/VDE Technological Center for Information Technology GmbH, the development of megachips is a typical case. This achievement is certainly noteworthy, but only if the purpose is also known, the chip card is an obvious example which also demonstrates the link existing between manufacturing and the service sector.

According to Petrella, the three major questions of the FAST program are the following: "Why is technology important for Europe?", "How can Europe keep pace with its competitors?", and "What are we doing in this area?" In his answer, he hinted that technology can and must facilitate the unification of European countries as they move toward the 21st century. Therefore, the FAST program is just as important for the development of human welfare and human life in Europe as it is for European aid to others, particularly to developing countries.

If Europe wants to keep up [with progress], the development of a real common market by 1992 is absolutely vital, because national fragmentation is an expensive [luxury] that will bring everything to a halt. In this connection, Petrella mentioned the development of European standards and the establishment of European companies and training systems rather than national ones. What has been done so far has been strongly hampered by member states and individual companies. As long as the EC spends roughly 70 percent on agriculture, the amount allocated to science and technology—less than 2 percent—is a mere drop in the ocean.

Since 1983, five themes have been discussed within the FAST program: —The relationship between technology, work, and employment; —The transformation of services and new technologies; —The strategic position of communications technology; —The future of nutrition; —The integrated development of renewable natural resources.

"Manufacturing Industry and Services are Strongly Interdependent"

The objective was to define modifications and adaptations required for technological development and its transformation—and the way in which these must be implemented—not only to increase efficiency, but also to obtain greater acceptance and to conform with a social pattern.

Dr Werner Wobbe, member of the FAST organization of the EC commission in Brussels said that structural changes in society and technology lead to the so-called meta-industry. Through new information and communications technologies, manufacturing industries and industrial services will become dependent on each other and the weight will shift to the service side. Wobbe takes into account the integration of technology families, human resources, and "anthropocentric technologies." The interaction between socio-economic and structural changes in society and technology must also be taken into account.

"The mastering of high technology alone does not automatically produce wealth," stated Dr Wobbe. The interconnection of various areas of technology spreads it from electromechanics through mechatronics to "optomatronics," to electromechanics by means of robotics, and communications technology, supported by optoelectronics. In his opinion, all this will not result in re-industrialization or a service or information society, but in the above mentioned meta-industrialization. In industrial policies, this would mean a nucleus of leading high-tech companies with peripheral suppliers of goods and services.

Wobbe uses the expression "Computer and Human Integrated Manufacturing," or CHIM for the related [concept of] "flexible specialization" in manufacturing with a new growth of small production units. According

to him, this represents an autonomous European approach with widespread human resources, manufacturing expertise, and specialists as a basis, and increased organizational flexibility as a requirement for the future. Within FAST, the term "Computer and Human Integrated System" or CHIS is employed. Consequently, Wobbe requests R&D programs for small production units with anthropocentric technologies, organizational knowledge, and concepts, as well as the necessary training for managers and employees.

"Flexibility and Adherence to Short-Term Objectives Required"

This event in Berlin presented the study "Key Technologies—Turbulent Change in the Industry through Innovative Dynamics," compiled during the previous 12 months by the "VDI/VDE Technological Center for Information Technology" within the framework of the EC program FAST. Klaus P. Friebe hopes that this publication will contribute to an acceptance and understanding of technology and its importance for society. The final assessment of the study included the statement that while success depends increasingly on flexibility, both in the rapid transformation of manufacturing operations and in the adherence to short-term completion dates, the flexible integration of large manufacturing areas raises complex control problems. The industrial society is destined to become increasingly complex and highly integrated and, therefore, increasingly susceptible to disturbance. According to Petrella, complex systems of this kind should be developed and operated by the same people, because these would be the best man-machine interface.

08617

EC Research Ministers to Approve ESPRIT 2nd Phase Program

3698m091 Duesseldorf VDI NACHRICHTEN in German No 45, 6 Nov 87 p 19

[Unattributed article: "New Subsidies From Brussels," "ESPRIT: Seconds Out of the Ring for the 2nd Round," "Equipment for the European Technology Community and an Exercise in Supranational Cooperation;" first paragraph is VDI-NACHRICHTEN introduction]

[Text] VDI-N, Brussels, 6/11/87—EC research ministers probably will start a new series of ratifications for the ESPRIT project by the end of November. With a delay of almost 1 year on the original timetable set by the EC Commission, this also officially starts the second phase of the program for the information technology sector, which in 1984 was scheduled for a 10-year term. A total of 1.6 billion ECU's is waiting for applicants.

The political foundations for relaunching of the most successful EC program so far were laid by the Council of Ministers a few weeks ago through the approval of the new EC framework program (1987-91). With a subsidy of approximately 1.6 billion ECU's (ECU=DM2.1), ESPRIT represents the largest portion of the framework program which, in turn, is intended to provide the EC with the means for a European technology community.

At present there are 201 individual projects within the ESPRIT program, all in a pre-competitive phase. A total of 240 industries from EC countries are participating. The areas of activity are microelectronics, information processing systems (software technology and advanced information processing), and applications for information technologies in computer integrated manufacturing and integrated office systems. According to the EC Commission, about 3,000 scientists—some of whom are highly qualified—cooperate in ESPRIT projects. By the beginning of the 1990's this number will almost double because of the growing importance of these areas of activity, according to an estimate drawn up by the EC commissioner responsible [for the program], Karl-Heinz Narjes. An interim report of the EC Commission states that: "Cooperation in Europe is stimulated by ESPRIT and is starting to show concrete, tangible results. Projects which are close to completion have met all their goals, and most of the projects which started later have met their intermediate goals."

In the area of software technology, the balance sheets of the commission emphasize the efforts of six of the largest European computer companies (Bull, GEC, ICL, Nixdorf, Olivetti, and Siemens) to develop a common software development system (PCTE). The objective is to achieve faster, more secure, and more economical production of software than would be possible with the present state of the art.

Remarkable results have also been achieved, according to the commission, within the framework of advanced information processing in the areas of knowledge-based technology, external interfaces, and computer architectures. A paper by the commission [states that]: "The strong European position in logic programming languages has been used to produce state-of-the-art versions of these languages which can be used in scientific processing systems."

The commission feels that ESPRIT has been particularly successful in connection with standards. "ESPRIT's influence on the work of standardization can be noticed internationally. The fact that European industry has spoken as one means that it is now in an excellent position to assume a leading role in the definition of world standards for IT [information technology], and to exploit the sales opportunities deriving from it."

08617

Britain Threatens Withdrawal From High Energy Physics Project

3698m093 Duesseldorf VDI NACHRICHTEN in German No 46, 13 Nov 87 p 19

[Text] VDI-N, Duesseldorf, 13.11.87—It appears that the British want to withdraw gradually from European cooperation not only as far as space travel is concerned

but also with regard to high energy physics. In the European nuclear energy research center, CERN, in Geneva there are growing fears that Britain could renounce its membership in 1989. This decision will be made this year. With a budget of over DM9 billion, CERN is the largest European research center in high energy physics. With 17 percent, Britain is the third largest contributor following the FRG (25 percent) and France (21 percent).

The present CERN program, especially the completion of the LEP (Large Electron Positron Accelerator), is not in danger, at least for the moment. Work will begin on the LEP in 1989 and should be completed in 1994. By then it will have taken up DM1.8 billion. For the time being the other CERN members are hoping to convince the British to stay on by suggesting a 15 percent reduction of the approximately 4000 scientists in order to save money.

In view of the current British tendency to consider participation in international scientific projects from a strictly economic point of view, this hope appears to be misleading. The British have been complaining for a long time that they do not receive enough of the orders resulting from CERN.

08701

Max Planck Institute Chief on R&D, Funding, FRG Space Policy

Space Policy Questioned

36980081 Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 25 Nov 87 p 7

[Article by gha: "Concern About Gene ral Basic Research. Manned Space Flight Criticized. Max Planck Society Annual Meeting"]

[Excerpts] Bonn, 24 Nov—The need to finance tax reform and the FRG's commitment to major manned space flight projects are making it harder to finance general basic research, fears [Heinz] Staab, the president of the Max Planck Society (MPG). At the MPG's annual press conference on Tuesday in Bonn, he described as "absurd" the idea that general cuts by the central and Land governments should affect research. Staab expressed harsh criticism of the decisions by the European Research Ministers on manned space flight, particularly on the Columbus laboratory module and the Hermes space glider, asserting that there is no adequate scientific justification for the anticipated spending. Since these plans are due mainly to foreign and European policy considerations, they should be financed with extra allocations from the general budget. If they are paid for out of the research budget, it could do irreversible damage to basic research capability; that in turn would also affect unmanned space flight, Staab said.

Although the MPG budget will increase by 5 percent for 1988, financial difficulties remain. The long-sought DM60 million special program to modernize the society's equipment still has not begun, due to the standoff between the central and Land governments, each of which provides 50 percent of the funding for the MPG. New institutes can be founded only through increased funding. First in line to be created would be a Max Planck Institute for Computer Science planned for Saarbruecken. How this is to be financed is still up in the air, however. Further new plans in high-seas biology, terrestrial ecology, and cognitive anthropology are being worked out in committee.

The MPG wants to strengthen scientific ties with the GDR and is attempting to reach an agreement with the East Berlin Academy of Sciences. The over 1600 visiting foreign scientists at Max Planck Institutes included only 40 from France in 1986 but 256 from the United States and 92 from Japan. Even compared to other European countries, the French percentage is unusually low . Staab expressed regret at this continuing situation, saying it is not in accordance with the good political and personal ties between the two countries.

Current Funding, Personnel

36980081 Duesseldorf HANDELSBLATT in German 25 Nov 87 p 18

[Article: "Max Planck Society: Attracts Foreigners Too. President Criticizes Bonn's Space Program"]

[Excerpts] HANDELSBLATT, Tuesday, 24 Nov 87; Bonn (DPA)—The 1986 annual report of the Max Planck Society notes that MPG institutes are working on more than 1,300 research projects in conjunction with research institutions in 49 countries. Among the spectacular cooperative agreements is the establishment of a scientific group at the Max Planck Institute for Plasma Physics in Garching, where researchers from Western Europe, Japan, the United States, and the Soviet Union are to work out plans for an experimental nuclear fusion reactor.

Staab said the attractiveness of the Max Planck Institutes was proved by their success in attracting back seven German scientists with permanent positions in respected American research bodies. Too the MPG was able to defeat several attempts to woo MPG directors to attractive positions abroad. Last year the Max Planck Society had 8,426 regular positions, of which 2,189 were for scientific personnel. There were an additional 3,612 visiting scientists and fellowship-holders.

The research budget next year will be about DM1.2 billion, compared to about DM1.7 billion for 1986 [as published].

12593

SUPERCONDUCTIVITY

FRG: Survey of High-Temperature Superconductivity Research

36900126 Bonn FEDERAL MINISTRY OF RESEARCH AND TECHNOLOGY in English Oct 87 pp 1-38

[Excerpts]

Activities in the Federal Republic in the Field of High-T_c Superconductors

The research activities in the field of high-T_c superconductors started immediately after Bednorz and Muller had published their research results. First, the uncoordinated activities were financed by the research institutions from the funds they had on hand, but soon they were coordinated and supported by the BMFT. The following events are of particular importance:

26 January 1987—Expert meeting in Dusseldorf on the progress made in superconductivity research and on its further development.

19 February 1987—Coordination meeting in Karlsruhe; proposal of an emergency programme for supporting university institutes.

12 March 1987—Special meeting on superconductivity in the framework of the spring meeting of the Deutsche Physikalische Gesellschaft in Munster.

April/May 1987—BMFT emergency programme for 30 university institutes aiming to provide initial help.

7 May 1987—Symposium of the German superconductivity research community in Marburg.

22 June 1987—Talks held by the federal minister for research and technology, Dr Riesenhuber, with leading representatives of superconductivity research.

30 June 1987—Press conference of the Federal Minister for Research and Technology on superconductivity research; increased research activities announced.

17 July 1987—Meeting with leading representatives of superconductivity research in Bad Honnef; promotion priorities established in basic research.

23 July 1987—Announcement of the BMFT concerning the promotion of basic research activities in the fields of:

- synthesis of new superconductors,
- preparation and characterization of solid materials and thin films,
- investigations into the theory of superconductivity,
- design and microstructure of conducting elements,
- improvement of the specific properties of superconductors.

23 September 1987—Announcement of the BMFT concerning the promotion of application-oriented research activities to study the technical potential of new superconductors in the fields of:

- conducting element structure,
- measurement technology on the basis of superconductivity,
- novel refrigeration concepts and refrigerants,
- new applications for superconductors,
- assessment of the technical and economic consequences of superconductivity technology.

29 October 1987—Congress on High-T_c Superconductivity in Karlsruhe

The BMFT's activities in the field of high-T_c superconductivity have, from the outset, been aimed above all at improving the information exchange and cooperation between research groups. Thus, with a view to establishing the necessary contacts between the various scientific disciplines, a R&D matrix was set up listing the research groups and their working priorities, and an express information system was established. both the matrix and the information system are continuously updated and expanded. Promotion funds for the field of physical technologies have been increased from an initial DM 4 million to DM 6.5 million in 1987.

Groups at the following institutions are involved in investigations into new high-T_c superconductors:

Institutes at

Universitat Koln	Universitat Giessen
Universitat Dusseldorf	Universitat Frankfurt
Universitat Dortmund	Universitat Mainz
Gesmathochschule Wuppertal	Universitat Kaiserslautern
Fachhochschule Munster	Universitat Saarbrucken
Universitat Hamburg	Universitat Karlsruhe
Universitat Kiel	Universitat Stuttgart
Technische Universitat Braunschweig	Universitat Tubingen
Universitat Gottingen	Universitat Konstanz
Freie Universitat Berlin	Universitat Bayreuth
Technische Universitat Berlin	Universitat Erlangen/Nurnberg
Universitat Marburg	Universitat Regensburg
Universitat Munchen	Technische Universitat Munchen

Kernforschungsanlage Julich
Kernforschungszentrum Karlsruhe
Physikalisch-Technische Bundesanstalt Berlin
Physikalisch-Technische Bundesanstalt Braunschweig
Battelle-Institut Frankfurt
Max-Planck-Institut Stuttgart
Walther-Meibner-Institut Munchen
Forschungsinstitut fur Edelmetalle Schwabisch Gmund

Industrial Firms

Siemens Munchen	Siemens Erlangen	Dornier
AEG	Daimler Benz	Hoechst
Philips	Kalichemie	Degussa
VAC	Goldschmidt	Vileroy & Boch
BBC		

The Fields of interest and work of the major groups can be seen from the detailed descriptions in the annex.

Future BMFT Promotion for Superconductivity and Low-Temperature Technology

Research promotion for physical technologies focusses on basic research in the initial phase and on applied basic research in the second phase. The areas promoted have been described in detail under No. 3 above "Activities in the Federal Republic in the Field of High-T_c superconductors," which refers to the announcements of 23 July and 23 September 1987. A synopsis of the research priority "superconductivity" is being prepared and will presumably be published in December 1987.

As a matter of principle, promotion is to be provided in the framework of cooperative research projects, thus intensifying cooperation between the various scientific disciplines and accelerating the information flow and technology transfer between science and technology. For the same reason, part of the funds needed by the institutes for carrying out application-oriented cooperative research projects are to be provided by the firms.

In a third phase, pilot projects and studies are to be launched dealing with the technical applications of superconductivity in the following fields:

- Measuring and analysing devices, microelectronics
- Cables for power transmission
- Magnets
- Switches
- Storage
- Transformers
- Traffic technology

There are suitable conditions in the Federal Republic for the application of superconducting systems in these fields.

For the promotion of superconductivity research in the framework of physical technologies, DM 6.5 million have been earmarked for 1987 and DM 16 million for 1988.

Freie Universitat Berlin Fachbereich Physik Institute for Atom-und Festkorperphysik (WE 1) Prof Dr K. Luders 9 November 1987

Research on High-T_c-Superconductivity at the Physics Department, FU Berlin

Presently several experimental and theoretical research groups at the Physics Department of the FU Berlin are studying High-T_c- Superconductivity. The main goals of the research program are:

a) Material preparation and characterization, b) Physical properties, c) The pairing mechanism.

The research groups and their special activities are:

- Baberschke: Magnetic measurements, critical magnetic fields
- Bennemann, Schotte: Electronic structure and pairing mechanism
- Kaindl: Photoemission and X-ray absorption
- Luders: MNR and NQR investigations, critical magnetic fields
- Muller, Reider: Ultrasonic experiments, bulk properties
- Riegel: Nuclear physics methods, ion implantation
- Wortmann: Mossbauer effect, coexistence of superconductivity and magnetism.

Besides concentrated work on Y-Ba-Cu-O and related rare earth alloys search is intended for new high-T_c materials. Cooperation concerning material preparation (single crystals) and characterization exists with other institutes in Berlin (Technical University, Physikalisch-Technische Bundesanstalt, BESSY (Synchrotron radiation).

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The microwave technology group within the institute of high frequency engineering at the Technical University of Braunschweig performs research on superconductor electronics: Applications of superconductor electronics in high frequency engineering, especially in microwave engineering are explored both theoretically and experimentally. Current work (1987) concerns.

1) Measurement of Surface Resistance of $YBa_2Cu_3O_7$ films at mm wave frequencies

2) Theoretical analysis of the current distribution in Josephson tunnel junctions which are operated on Shapiro steps. This work belongs to the development of improved chips for series array voltage standards.

3) Theoretical and experimental research on frequency selective Josephson detectors.

Physikalisch-Technische Bundesanstalt Braunschweig und Berlin

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Research on and application of high T_c superconductivity at PTB, Braunschweig

The PTB is interested in the application of high T_c superconducting materials for precision electrical metrology, particularly in the electronic device fabrication.

Program Objectives:

- Preparation and synthesis of presently known high T_c materials as well as new materials
- material characterization including far infrared and Raman spectrometry
- interaction of Josephson point contact junctions with electromagnetic radiation
- preparation and study of single layer and multilayer thin films
- development of single layer and multilayer thin films devices
- test of the device properties for precision electrical metrology

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Research on Superconductivity at TH Darmstadt

The THD activities are part of the research program of the Sonderforschungsbereich 252 Darmstadt/Frankfurt-/Mainz/Stuttgart, in which "metallic materials exhibiting strong electronic correlations" are studied by a broad spectrum of experimental and theoretical techniques. It is the aim of this program to unravel the role of electronic correlations in such exotic ground state properties of condensed matter as heavy fermions (including their superconductivity) and high-T_c superconductivity.

Present activities at Darmstadt focus on the investigations of poly-crystalline high-T_c materials in the form of either sintered powders or bulk polycrystalline samples. Part of this work is being performed in collaboration with the MPI Stuttgart, the University of Tubingen and, in most cases, the Kernforschungszentrum Karlsruhe. Recently, single crystals became available from the materials preparation lab of the Sonderforschungsbereich at the University of Frankfurt. It is planned to install facilities for single crystal growth and thin film production also at the THD. Since thin films are required for several promising applications of high-T_c superconductivity, notably "superconducting electronics," a collaboration with industry is presently being discussed.

1) Program Objectives

a. Bulk material:

- Preparation and Structural characterization (B. Elschner, F. Steglich)
- Characterization of physical properties: DC magnetization, RF Susceptibility, specific heat, thermal expansion, electrical and thermal conductivity, thermo-electric power, Hall effect, ESR, NMR (B. Elschner, F. Steglich, G. Weber)
- Theoretical investigations: First-principle calculations of electronic and magnetic properties, analysis of strong electronphonon coupling mechanisms (Jahn-Teller effect) (K.-H. Hock, J. Kubler)

b. Thin films (in planning)

- Preparation
- Analysis, structural and chemical characterization
- characterization of physical properties

2) Research Accomplishments

- Synthesis of La_2CuO_4, $La_{1-x}Sr_xCuO_4$ and $YBa_2Cu_3O_7$
- Measurement of Meissner and shielding effects, lower critical field, upper critical field slope, Ginzburg-Landau parameter
- Measurement of RF susceptibilities
- Measurement of transport properties: electrical and thermal conductivities, thermoelectric power
- Measure of specific heat
- Measurement of thermal expansion, pressure derivative of T_c
- Measurement of ESR
- Measurement of NMR

Physikalisches Institut Universitat Erlangen-Nurnberg Erwin-Rommel-Str. 1 D-8520 Erlangen, FRG

Persons to Contact:

Prof Dr G. Saemann-Ischenko Physikalisches institut Universitat Erlangen-Nurnberg Erwin-Rommel-Str. 1 D-8520 Erlangen, FRG Phone: 09131/85 7092

Priv-Doz Dr H. Adrian Physikalisches Institut Universitat Erlangen-Nurnberg Erwin-Rommel-Str. 1 D-8520 Erlangen, FRG Phone: 09131/85 7093

The research program on High-T_c-Superconductivity is directed towards the clarification of the microscopic mechanisms responsible for superconductivity in the known high T_c-oxide materials and an understanding of their intrinsic normal state and superconducting properties. Parallel to this basic research the focus is on material science aspects in order to develop material suitable for technological application. In this respect the activity is centered on thin film technology, which is crucial for planar thin film devices and promises also a greater potential as conductor for high field, high critical current application compared to ceramic bulk material.

A. The research program contains the following Section:

1. Material Science of Thin Films

Thin films preparation by various deposition techniques, interaction of the deposited film with substrates. Besides reproducing the results on $SiTi0_3$-single crystals the emphasis is directed towards the possibilities of preparing high quality films on more common substrates, such as sapphire, and also technical substrates, such as fibres and ribbons. Analysis of the films by Rutherford-Backscattering of high energy ions, X-ray diffraction and Augerspectroscopy. Dependence of normal state electronic transport properties and superconducting properties (T_c,B_{c2}(T), j_c(B,T) on the microstructure and texture and investigation of the potential to control the microstructure by deposition parameters and heat treatment. Characterization by density measurements, scanning electron microscopy and ceramography.

2. Basic Physics with Thin Films

Influence of irradiation induced defects on physical properties of thin films (and bulk material). Emphasis is here on the measurement of a wide spectrum of properties (T_c,B_{c2}(T), gr(T), gDgr(B,T), Hall-Effect, J_c(B,T)...) in order to obtain information about the microscopic mechanism responsible for the observed T_c-degradation. The step by step modification of the properties of a individual sample gives access to correlations between the measured properties which can be tested in respect to consistency with the conventional theory of superconducting and other theories proposed in the future. Preparation of thin film tunnel-junctions and break-junction. Measurement of tunneling characteristics between high-T_c thin films by a vacuum tunnelling technique using a squeezer. Determination of the value and the temperature dependence of the superconducting energy gap. analysis and interpretation of the tunneling characteristics in the framework of conventional and novel theories.

3. Effects of Chemical Substitution

Chemical substitution of the constituents in $YBa_2Cu_3O_7$. Crystallographic characterization by X-ray and n-diffraction. Measurement of normal state transport properties, superconducting critical parameters, dc-magnetization, specific heat, pressure dependence of T_c and resistivity, UPS/XPS-photo-electron spectroscopy, Mossbauer-effect and neutron scattering. The aim of this project is to correlate microscopic properties such as electronic structure, lattice parameters, phonon dispersion, magnetic fluctuations etc. with the observed variation of T_c upon chemical substitution. This is expected to provide information about the microscopic mechanism of the high-temperature superconductivity, and to give hints for chemical substitutions which increase T_c or for new compounds with even higher critical temperature.

4. Experiments on Single Crystals

Preparation of single crystals of high-T_c-material by various flux methods. Investigation of the intrinsic electronic anisotropies by transport measurements. Correlation of these electronic anisotropies to the superconducting anisotropy of critical field, coherence length and penetration depth. Pinning efficiency of defects and twin-boundaries for enhancements of critical current densities. Search for novel phenomena correlated with the unusually short coherence length in high-T_c compounds.

5. Search for Other High-T_c-Compounds

Based on the work in sections 1-4 it is hoped to gather information in order to conduct a successful search for other systems with high-T_c superconductivity.

6. High Resolution X-ray Diffraction (in coll. with Prof Burzlaff, Erlangen)

High resolution X-ray diffraction will be used to solve the crystallographic problems which will be encountered in this research program. This includes also the question whether alternative crystal structures are compatible with the experimental scattering intensities. Additionally the structural changes due to chemical substitution and irradiation induced lattice defects will be investigated.

7. Far-Infrared Spectroscopy (in collaboration with Prof Renk, Regensburg)

The complex dynamic conductivity is determined by measurements of the wave number dependence of the reflectivity. From this the superconducting energy gap is determined and information about phonon properties is obtained.

8. Preparation of ceramic material (in coll. with Prof Tomandl, Erlangen)

The potential of alternative preparation processes is determined. Methods well established for other ceramics will be adopted for preparation. Coating techniques and thin film deposition techniques as well as the possibilities for 3-dimensional structures will be exploited.

9. Electrochemistry (in collaboration with Prof Lenz, Karlsruhe)

The electrochemical investigations study the stability of the compounds against reactive media. The voltametric measurements analyse the conditions for surface segregation, the production of precipitations and the degradation of the structure.

B. Further Information About Research Accomplishments on HTSC, Other Research Programs and Facilities

Research Accomplishments on HTSC (Nov 1987):

- Synthesis of $La_{2-x}M_xCuO_4$ (M=Sr,Ba), $YBa_2Cu_3O_7$ and compounds related by substitution.
- Preparation of superconducting $YBa_2Cu_3O_7$-Films
- Measurement of transport properties, critical fields, magnetization and specific heat
- Far-infrared reflectivity of bulk samples
- Determination of T_c and resistivity behavior and crystal structure of bulk material after fast neutron irradiation
- Establishment of the T_c-behavior upon substitution of Cu by Ni
- Surface segregation of bulk $YBa_2Cu_3O_7$ after voltamatic measurements in various environments
- First results for tunneling experiments

Research on Superconductivity in Heavy-Fermion Systems and Amorphous Metals

For many years research programs on superconductivity in Heavy-Fermion-Systems and Amorphous Metals have been conducted which are continued. The main aspect of the research on heavy-fermion-systems is the dependence of the heavy-fermion-groundstate on chemical substitution and lattice disorder. For this purpose the formation of heavy quasiparticles, the low temperature coherence effects, superconductivity and anomalies in transport properties are investigated. The resulting changes of the electronic structure are studied by Photoelectron Spectroscopy.

Concerning superconductivity in amorphous metals, research centers on the correlations of microscopic structural parameters with electronic transport properties and superconducting critical parameters. Special interest is devoted to computer-simulation of amorphous structures, preparation of thin films and the investigation of Anderson localization and electron interaction effects. Further, the mechanisms for formation of amorphous metals by inter-diffusion of metallic multi-layers are studied.

Existing Facilities:

- ^{3}He-^{4}He dilution refrigerator with 8T-magnet
- ^{3}He-cryostat with 13.5T-magnet
- Several ^{4}He-cryostats, partly with superconducting magnets
- Low-temperature irradiation facility with cryostat for in-situ measurements (at Tandem-accelerator)
- Photoemission-facility (XPS/UPS) with auxiliary equipment
- Rutherford-Backscattering facility (at Tandem-accelerator)
- X-ray diffractometer, including cyrostat for low temp X-ray work
- Measurements of:
- transport properties, magnetoresistivity, Hall-effect
- critical field, critical currents
- ac-susceptibility
- dc-magnetization
- specific heat
- T_c and gr under pressure
- thermopower and thermal conductivity
- tunneling characteristics
- Several sputtering chambers and evaporators
- Arc-melting facility
- Furnaces for heat-treatments

University of Goettingen D-3400 Gottingen, FRG

Superconductivity Points of Contact: General Information:

H.C. Freyhardt Institut fuer Metallphysik Hospitalstr. 3/7 D-3400 Goettingen (0551) 39-4492, 39-5011

K. Winzer I. Phys. Institut Bunsenstr. 9 D-3400 Goettingen (0551) 39-7609, 30-7602

Research on High-T_c Superconductivity at the University of Goettingen

An interdisciplinary group of scientists at the University of Goettingen concentrates on the reproducible synthesis, preparation and the shaping of ceramic high-T_c superconductors. Complementary physical and chemical methods are employed to study—and to optimize—their structure and microstructure; electro-chemical investigations give insight in the thermodynamical description of these systems. Thin films are prepared by sputtering, electron-beam and laser evaporation. single crystals, grown by different methods, are used to answer basic questions (carrier concentrations and mobilities, anisotropic behavior, etc.) With regard to technical applications, various techniques are tested for the preparation of wire, ribbon and composite high-T_c conductors.

Program Objectives

Freyhardt, Krebs, Heinemann, Wordenweber (Inst F. Metallphysik)—Bulk and thin film preparation techniques, structure and structural transformation, microstructure, critical properties (critical magnetic fields and currents).

Bormann (Inst. f. Metallphysik), Nolting (Phys. Chemie)—Thermodynamic behavior, electro-chemical measurements (also in connection with thin film techniques)

Hehenkamp, Luhr-Tanck (Inst. f. Metallphysik)—Phase diagrams, atomic transport mechanism, point defect analysis

V. Minnigerode, Samwer (I. Phys. Institut)—Thin film preparation techniques and thin film characterization by complementary methods, layered films

Beuermann, Winzer (I. Phys. institut)—Single crystals, fundamental superconducting parameters (including the determination of an energy gap), electrical-transport and thermal properties

Helberg (III. Phys. Institut)—Microwave conductivity

Kupcik (Mineralogisch-Kristallographisches Institut)—synthesis (including single crystals), X-ray investigations of phase transformation,s spectroscopy (ESR)

Schwarzmann (Anorgan. Chemie)—synthesis, chemical analysis, single crystals

Uhrmacher (II. Phys. Institut)—Ion implantation, radiation damage, nuclear methos (RBS, PAC, Etc.)

Walther-Meissner-Institute for Low Temperature Research

Contact:

Prof Dr K. Andres WMI, Walther-Meissner-Str. 8 D-8046 Garching FRG

Research in High T_c-Materials

Recent accomplishments:

Since February 1987, the WMI is synthesizing the new high-T_c materials and investigating their magnetic and calorimetric properties. Emphasis so far has been on measurements of the specific heat down to very low temperatures as a function of oxygen content in order to study the transition from the magnetically ordered state to the superconducting state. Another effort has been directed towards optimizing the synthesis of sintered $YBa_2Cu_3O_7$ in order to obtain material with high homogeneity and high supercurrent-carrying capacity. Material with a diamagnetic shielding capacity equal to that of lead has been obtained.

Research facilities:

- Mills and Automatic furnaces for materials preparation.
- Scanning electron microscope for microstructure analysis.
- Electron-diffraction microscope.
- Vibrating magnetometer for magnetization and susceptibility measurements.
- Vibrating magnetometer for magnetization and susceptibility measurements.
- Low temperature SQUID magnetometers for low field and low temperature measurement.
- Cyrostats for specific heat measurements down to 10 mK.
- 4-lead as well as eddy-current methods for conductivity measurements.
- Cryostat for thermal conductivity measurement.

Future objectives:

Further study of excitations from the superconducting ground state by means of specific heat and thermal conductivity measurements, also in high applied fields. Synthesis of single crystals. Further improvement of sinter materials. Synthesis of thin films by the sputtering technique. Manufacturing of weak links for SQUID applications out of both thin film and bulk sinter materials.

University of Goettingen D-3400 Goettingen, FRG

Superconductivity Points of Contact: General Information:

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K. Winzer I. Phys. Institut Bunsenstr. 9 D-3400 Goettingen (0551) 39-7609, 30-7602

Research on High-T_c Superconductivity at the University of Goettingen

An interdisciplinary group of scientists at the University of Goettingen concentrates on the reproducible synthesis, preparation and the shaping of ceramic High-T_c superconductors. Complementary physical and chemical methods are employed to study—and to optimize—their structure and microstructure; electro-chemical investigations give insight in the thermodynamical description of those systems. Thin films are prepared by sputtering, electron-beam and laser evaporation. Single crystals, grown by different methods, are used to answer basic questions (carrier concentrations and mobilities, anisotropic behavior, etc.). With regard to technical applications, various techniques are tested for the preparation of wire, ribbon and composite high-T_c conductors.

Program Objectives

Freyhardt, Krebs, Heinemann, Wordenweber (Inst. f. Metallphysik)—Bulk and thin film preparation techniques, structure and structural transformations, microstructure, critical properties (critical magnetic fields and currents).

Bormann (Inst. f. Metallphysik), Nolting (Phys. Chemie)—Thermodynamic behavior, electro-chemical measurements (also in connection with thin film techniques)

Hehenkamp, Luhr-Tanck (Inst. f. Metallphysik)—Phase diagrams, atomic transport mechanisms, point defect analysis

V. Minnigerode, Samwer (I. Phys. Institut)—Thin film preparation techniques and thin film characterization by complementary methods, layered films

Beuermann, Winzer (I. Phys. Institut)—Single crystals, fundamental superconducting parameters (including the determination of an energy gap), electrical-transport and thermal properties

Helberg (III. Phys. Institut)—Microwave conductivity

Kupcik (Mineralogisch-Kristallographisches Institut)—High-resolution structural investigations

Bente (Mineralogisch-Kristallgraphisches Institut)—Synthesis (including single crystals), X-ray investigations of phase transformations, spectroscopy (ESR)

Schwarzmann (Anorgan. Chemie)—Synthesis, chemical analysis, single crystals

Uhrmacher (II. Phys. Institut)—Ion implantation, radiation damage, nuclear methos (RBS, PAC, etc.)

University of Hamburg Physics Department Jungiustrasse 9 2 Hamburg 36

"Theoretical Research on High T_c Superconductivity"—J Appel, I. Institut fur Theoretische Physik , Hamburg

Our interest focusses on the theoretical understanding of the High T_c superconductivity and in particular on the quantum theory of non-phonon pairing interactions and the symmetry and physical properties of the correlated fermions and of their superconducting order parameters. We wish to understand the pertinent experimental data which probe the fermions on an atomic scale, such as NMR, EPR and the Mossbauer spectroscopy.

Publ: (Also presented at the Berkeley Conference)

"A Mean-Field Theory of High T_c Superconductivity: The Super-Exchange Mechanism" with A.R. Ruckenstein and P. Hirschfeld

Contact:

Prof A. W. Overhauser, Purdue University Prof A. R. Ruckensten, UCSD Dr P. Hirschfeld, Stanford University Dr R. Hammond, Stanford University Prof T. Geballe, Stanford University Prof T.S. Ting, Houston University

Institute for Solid State Research (IFF) At KFA, D-517o Julich (FRG)

Superconductivity Points of contact:

Prof Dr W. Zinn Nuclear Research Center Julich (KFA) Institute for Solid State Research (IFF) P.O.B. 1913 D-517o Julich Phone: 02461/61-4443

Dr B. Stritzker Nuclear Research Center Julich (KFA) Institute for Solid State Research and Institute for Thin Film and Ion Beam Technologies (IFF/ASI) P.O.B. 1913 D-517o Julich Phone: 02461/61-3285

Research on High-T_c Superconductors at IFF

The KFA program on high T_c superconductors extends on both classes of the new oxide superconductors, i.e. $(La,Sr)_1Cuo_4$ and $Yba_2Cu_3O_{1-x}$.

Basic research activities as well as the exploration of new technical applications are within the scope of the KFA program.

Emphasis in the KFA research program is laying on the controlled preparation of single crystals for the study of the intrinsic material properties and, in particular, of thin films to be used in circuit elements for microelectronics and information technology as well as for preparing layered and sandwiched film systems for basic research topics. The current efforts are aiming mainly at the preparation of oriented or single crystalline films on proper substrates by molecular beam epitaxy and by sputtering techniques.

The goal is to achieve the maximum values for the critical current densities, for the critical magnetic fields, and for the high T_c. Preparation of layered structures and sandwiched film systems are planned too for studying the mutual electronic and magnetic interactions and interface reactions between s.c. films and ferromagnetic (or) semiconducting layers.

Also on the program is the lateral structuring of the superconducting films by means of optical lithography and ion beam etching. Modifications of special properties by substitution on the various La-, Y-, Ba-, Cu- and O-sublattices by different atoms are further tools for experiments towards a better control and basic understanding of the materials properties.

The whole available potential of the KFA institutes for solid state and surface physics and research will be used to characterize the crystal structure, chemical composition and the physical properties of this new class of materials. Among these are e.g. various X-ray, laser and synchrotron radiation techniques as well s neutron and ion scattering methods. Also nuclear resonance and electron spectroscopy is widely used to characterize the bulk as well as the film and interface/surface properties. Sensitive and powerful experimental techniques are also available to study the temperature, magnetic field, and pressure dependence of the magnetic, electric and transport properties in detail.

High resolution electron microscopy,tunneling microscopy and spectroscopy and spin polarized electron spectroscopies can be applied too for clarifying special structural and electronic material properties.

All outlined activities are part of the KFA program areas focussed on materials research (FKF) or on basic research for information technology (PGI).

Additional information may be obtained by contacting one of the following KFA scientists:

Prof Dr K. Urban (IFF)	for electron microscopy studies of the microstructure
Prof Dr W. Wenzl (IFF)	for material development and crystal growth problems
Prof Dr W. Zinn (IFF)	for MBE of films and film systems and their electric and magnetic characterization
Dr B. Stritzker (IFF/ASI)	for ion beam techniques and applications of s.c. films
Dr U. Poppe (IFF)	for sputtering of films and sandwiched structures, and for tunneling spectroscopy
Dr J. Witting (IFF)	for high pressure studies
Dr H. Lutgemeier (IFF)	for NMR and NQR studies
Dr H. Maletta and Dr U. Kobler (IFF)	for susceptibility and magnetization studies
Dr W. Gudat (IFF)	for electronic properties and XPS or electron spectroscopy

Kernforschungszentrum Karlsruhe Postfach 3540 D-7500 Karlsruhe 1, FRG

Superconductivity Points of Contact:

Fundamental Research Professor Dr H. Rietscshel Institut fur Nukleare Festkorperphysik

Application Developments Professor Dr P.Komarek Institut fur Technische Physik

The KfK program on low temperature and superconductivity research contains a broad span of areas on basic science for classical and the new High T_c superconductors, on technological developments and on applications of superconductivity up to large scale projects.

The basic science work includes theory, synthesis of materials and measurement of physical properties to improve understanding and to get guidance for better materials. At present strong emphasis is given to the new High T_c superconductors. Substantial contributions for La-and Y-based materials in synthesis, characterization and interpretation of a broad variety on measurements have been done already from the beginning after the discoveries.

The material development for application contains classical high field superconductors, as e.g. Chevrel-Phase wires for very high, but also attempts to find metallurgical means to prepare wires and thin sheet tapes with the High T_c superconductors.

The projects for application are carried out towards electrical engineering. Major emphasis is given to nuclear fusion magnet systems, where the work is part of the EURATOM fusion technology program. An other goal is very high field magnet systems for different applications.

Cryogenic development work is accompanying the applied projects, physics questions in this area concern He I and He II flow behavior, transient heat transfer properties and measuring techniques.

Program Objectives:

Synthesis and Characterization of (l) High T_c superconducting materials as bulk, thin sheets and wires (2) conventional superconductors, especially based on powder metallurgical processes

Theoretical interpretation of physical properties of the superconductors.

Construction of test winding with all types of advanced superconductors made available for such purposes.

Development of magnets for very high fields.

Development of s.c. toroidal fields coils for tokamaks, especially for NET (Next European Torus).

Development of s.c. poloidal field coils for tokamaks, especially for NET.

Cryogenic developments for magnet projects, especially He I and He II forced flow techniques.

Institute of Inorganic Chemistry University Kiel Olshausenstr. 40-60 D-2300 Kiel

Superconductivity Points of Contact:

Prof Dr Hanskarl Muller-Buschbaum Institute of Inorganic Chemistry University Kiel Olshausenstr 40-60 D-2300 Kiel Phone: (0431) 880-2410

Dr Christoph Ludwig Teske Institute of Inorganic Chemistry University Kiel Olshausenstr. 40-60- D-2300 Kiel Phone: (0431) 880-2408

Research on High-T_c Superconductivity at the Institute of Inorganic Chemistry

The subject of the research concerning superconductivity deals with preparation of ceramic materials, especially with oxocompounds of copper and related elements to obtain new or modified substances with superconducting properties. The basic research includes X-ray methods and Differential Thermal Analysis (DTA) in combination with Thermogravimetry (TG) and difference-Scanning-Calorimetry-Analyses (DSC). The identification of new phases is supported by energy dispersive X-ray analysis (EDX). Furthermore the influences of the preparation parameters, temperature and oxygen pressure, on the crystal chemistry of these solids are studied. The possible replacement of copper by other coplanar coordinated elements is another goal of future experiments.

In addition to the experimental research we perform theoretical calculations of the coulomb term of lattice energy of distinct point positions to support structural considerations concerning coordination numbers and oxidation states of the metal- and oxygen ions in superconducting materials.

Contact Address:

Dieter K. Wohlleben Gernot Guntherodt II. Physikalisches Institut Universitat zu Koln Zulpicher Strasse 77 5000 Koln 41 FRG Phones: 0049-221-470 2707(D.W.) - 3568(G.G.)

Research on High T_c Superconductivity at the II. Physikalisches Institut of the University zu Koln (Cologne, FRG)

The group comprises about 20 coworkers, more than half of which are Diplom and PhD students. The group was previously involved in experimental research in the physics of valence fluctuations and Heavy Fermion systems.

The program on High T_c Superconductivity includes synthesis and characterization of the known High-T_c materials in polycrystalline and single crystalline form; the latter comprises x-ray diffractometry, microprobe analysis, Electron microscopy studies, transport properties (resistivity, thermal conductivity, thermopower, Hall effect), thermodynamic properties (specific heat, thermal expansion, bulk modulus) and spectroscopies (inelastic neutron scattering, Raman scattering L_{III} x-ray absorption, point contact spectroscopy). At this time particular emphasis is on the experimental and theoretical study of the interrelation between superconductivity and microstructure (twinning).

In cooperation with the institute for Anorganic Chemistry at this university, a search for superconductivity in materials with one and two dimensional electronic structure is planned.

Research Accomplishments to date:

- Synthesis of $La_{1-x}M_xCuO_c$ and of $YBa_2Cu_3O_7$, the latter with Y replaced by rare earths and with Cu substituted with 3d elements
- Temperature dependent x-ray diffraction
- Specific heat measurements (4 - 300 K)
- Magnetostriction measurements
- Search for isotope effect on Cu, Ba
- Raman spectroscopy
- Theory of superconductivity by Quantum Size Effect

University of Konstanz Dept of Physics P.O. Box 5560 D-7750 Konstanz (FRG)

Superconductivity Points of Contact:

A) Organization:

Dr M. Ch. Lux-Steiner Dept. of Physics P.O. Box 5560 D-7750 Konstanz (FRG) Phone: 07431-2088(business) 07543-3975(home) Telex: 0733359 univ.d Telefax: 07531-883688

B) Technical Contact:

Prof E. Bucher Dept. of Physics Applied Solid State Science P.O. Box D-7750 Konstanz (FRG) Phone: (49)7531-88-2073 (41)72-72-51-41 Telex: 0733359 univ.d Telefax: 07531-883688

Research Program

1) New Ceramic Oxides:

Exploration of new Ceramic materials based on intermediate valence compounds, Spin singlet systems, metal/insulator systems and Jahn-Teller ions. Many of these systems do not involve Cu^{2+}/Cu^{3+} systems. Materials analysis is routinely done by susceptibility and resistance measurement between 4.2 and 300 K. collaboration with Ceramics Industry is under way.

2) Thin Film Research:

Deposition of 90-100 K superconducting thin films is performed via reactive sputtering of targets and reactive evaporation of metals followed post-treatment in oxygen plasma generated by a microwave cavity or glow discharge. The main purpose of the study of such superconducting films is their preliminary exploration as contact- or barrier metals in photovoltaic applications, LED's, and as carriers for undistorted signals, possibly for telecommunications in superconducting cables.

Collaboration with Electronics Industry is anticipated as soon as deposition station will function.

3) Technologies for High D.C. Current Transport:

The development of high field coils and wires with current capacities in excess of 10^6Amp/cm^2 will need new special technologies, which will be studied in collaboration with the Metallurgy Industry. Details cannot be disclosed at this point, due to possible patent restrictions.

Accomplishments

Synthesis of $EuBa_2Cu_3O_x$ for Mossbauer-Effect studiers, as well as mixed oxides of similar nature, such as $YBa_{2-x}Sr_xCu_3O_x$ has been performed. Studies to Ti^{3+} compounds (S = 1/2, similar to Copper Cu_{2+}) have not lead to superconductivity so far (e.g. Sr_2TiO_4, $LaTi_2O_{4NaTiO_2}$ based materials, $La_{1-x}Th_x\ TiO_3$ etc.).

University of Regensburg 8400 Regensburg, FRG

Contact:

Karl F. Renk University of Regensburg Department of Physics Universitatsstr. 31 8400 Regensburg, FRG Phone: (0941) 943-2070

Research on High-T_c Superconductivity at the Physics Department of the University of Regensburg

We are preforming experimental and theoretical studies on High-T_c superconductors. We have cooperation with the University of Erlangen, the Max-Planck-Institut fur Festkorperforschung in Stuttgart, and the University of Texas, Austin.

The main interest of our studies concerns the synthesis of Y-Ba-Cu-O ceramics and crystalline material in the search for new materials; furthermore the measurement of physical properties. Of main interest is the application of far-infrared spectroscopy for determination of the dynamical conductivity. In these experiments we try to obtain both the electronic and vibrational properties that are characteristic for High-T_c superconductors. In our theoretical studies we are working on a theoretical analysis of electronic properties such as fluctuation effects and on calculation of the vibrational properties by using lattice dynamics.

1) Program Objectives

a. Synthesis and Characterization

- Characterization of new High-T_c materials; crystal structure, microstructure, and various physical other properties, especially far-infrared reflectivity.
- Theoretical interpretation of the dynamical conductivity.
- Identification of dynamical lattice properties; phonon dispersion curves.
- Synthesis of new highly conducting materials.

b. Thin Films

- Study of physical properties such as far-infrared reflectivity and Transmissions

2) Research Accomplishments

- Synthesis of $YBaCu_3)_2$ and compounds related by substitution.
- Investigation of the crystalline structure and microstructure.
- Synthesis of a ceramic sample with a preferred orientation of the microcrystals; measurement of the far-infrared properties.
- Lattice dynamical properties of La_2CuO_4.

3) Coworkers on the Program in Regensburg

- Prof Dr K.F. Renk, Institut fur Angewandte Physik
- Priv Doz Dr H. Otto, Fakultat fur Physik
- Prof Dr J. Keller, Institut fur Theoretische Physik
- Prof Dr U. Schroder, Institut fur Theoretische Physik

Forschungsinstitut fur Edelmetalle Und Metallchemie Katharinenstrasse 17 7070 Schwabisch Gmund

Superconductivity Points of Contact:

Dr Ch.J. Raug (Institutsleiter) FEM, Katharinenstrasse 17 7070 Schwabisch Gmund Phone: 07171-62054

Prof Dr H.R. Khan Low Temperature Laboratory FEM, Katharinenstrasse 17 Phone: 07171-62054

Research on High T_c-superconductivity at FEM, 7070 Schwabisch Gmund

The Forschungsinstitut fur Edelmetalle und Metallchemie, 7070 Schwabisch Gmund has been engaged in research on superconducting materials including oxides and sulphides for the last many years. At present the research program on high T_c-materials has been intensified and consists of the synthesis of high T_c-materials of various compositions and components, their characterization by chemical analysis and energy dispersive X-ray analysis and Micro-structural investigations by optical and scanning electron microscopy. the Crystal structure is determined by X-ray diffraction at low and high temperatures. The superconducting transition temperature is determined inductively and resistively as a function of composition and structure. The electronic structure of these materials is investigated by measuring the temperature dependent electrical resistivity up to 1100 K and magnetic properties at low and high (1100 K) temperatures.

The synthesis as well as the measurement of physical properties are aimed to improve the superconducting properties for example the critical current density and ductility of these materials. There is also a program of the fabrication of thin films of High T_c-materials in collaboration with the Industry. The characterization and the measurement of the physical properties of these films will be made in order to improve the properties to suit the technical applications.

1. Program Objectives

Synthesis and characterization:

Synthesis of High T_c-materials of various compositions, characterization by chemical analysis and energy dispersive X-ray analysis for chemical composition, crystal structure determination by X-ray diffraction at low and high temperatures, Microstructure investigation by optical microscopy and scanning electron microscopy, measurement of superconducting transition temperature inductively and resistivity.

Physical properties and electronic structure by measuring the electrical resistivity as a function of temperature, magnetization as a function of temperature and magnetic field. Hardness and ductily.

Fabrication of high quality thin films in collaboration with industry, their characterization and improvement for the technical applications.

2. Research Accomplishments

Synthesis of High T_c-materials of Re (Y, Ho, Nd) -Ba-Cu-O, R.T. crystal structure determination by X-ray diffraction.

Micro-structure by REM and characterization by EDX.

Superconducting transition temperature (inductively and resistivity) for different compositions.

Measurement of electrical resistivity as a function of temperature and magnetic properties.

University of Saarland

Research and Development of High T_c-Superconducting Ceramics

At the University of Saarbrucken a small group of scientists of different institutes cooperates in the investigation of high T_c superconducting ceramics. The program spans the area of:

1) Basic sciences, especially towards a better understanding of the electronic properties (by photoelectron spectroscopy) of these ceramics and its dependence on the preparation conditions;

2) Synthesis and characterisation of ceramics and thin films based on the Y-Ba-Cu-O system and investigation of new systems;

3) Synthesis of single crystals of the Y-Ba-Cu-O and $La_{2-x}Me_xCuO_4$ system.

4) Investigation of electrochemical and ionic transport mechanisms in the ceramic compounds;

5) Cooperation with industrial laboratories for preparation of materials with reproducible physical properties, which can be used for technical applications.

For further information contact:

Prof. S. Hufner Dr P. Steiner Fachrichtung Experimentalphysik Universitat des Saarlandes Bau 22 Phone: 0681/302-2407 6600 Saarbrucken/Germany

Dr H. Schmitt Farchrichtung Technische Physik Universitat des Saarlandes Bau 38 Phone: 0681/302-2716

Max-Planck-Institut fur Festkorperforschung

Superconductivity Points of Contacts:

M. Cardona L. Genzel C. Thomsen Max-Planck-Institut fur Festkorperforschung Heisenbergstrasse 1, D-7000 Stuttgart 80 Federal Republic of Germany Phone: 0711/6860-711 Bitnet: CARDONA AT DS0MPI11, THOMSEN AT DS0MPI11

Research Activities on High-T_c Superconductors at the Max-Planck-Institut fur Festkorperforschung

The Max-Planck-Institut has put a large research effort into the synthesis and investigation of the new High T_c superconductors. Of primary interest have been the controlled preparation of high quality materials and the analysis of fundamental physical properties that could lead to an understanding of the superconducting mechanism.

The fundamental properties at the focus of the research activity at the Max-Planck-Institut are the lattice vibrations of the superconductor and electron-phonon interactions. The objective of the studies is to establish a relation between the new form of superconductivity and optical modes of the lattice. The detailed knowledge of these interactions is essential in deciding whether or not superconductivity is a phonon mediated mechanism. The high temperature superconducting energy gap has been found in the far infrared spectra measured at the Institute and indications for a second, higher gap were seen as well. These findings are of equal importance of the understanding of superconductivity in this new call of materials. To achieve controlled parameters and reproducibility in the sample preparation, the materials are synthesized and characterized in house by x-ray

diffraction, dc resistivity, and Meissner effect measurements. The preparation include that of sintered materials, as well as single crystals, and thin films. Due to the intense research efforts of the Max-Planck-Institut in this area a number of results and conclusions have already been published or submitted for publication.

1) Achievements in Raman and Far Infrared Spectroscopy:

- Detection of the superconducting energy gap
- Mode analysis of the unit cell
- Mode assignment of phonon peaks
- Anomalous temperature dependence of phonon frequencies
- Oxygen dependence of phonon modes
- Systematic study of rare earth replacements for Y: what do the phonons do?
- Detection of additional phases with resonance Raman scattering below the detection level of x-ray diffraction
- Analysis of the phonon modes of the semiconducting analog $MBa_{23}O_6$
- Replacement of ^{16}O by the isotope ^{18}O
- Lattice dynamical calculations of phonon modes
- Evidence for superconductivity in the planes

2) These studies are currently under way or planned for the future:

- Measurements of the optical properties in the near and middle infrared, the visible, and UV.
- The system $La_{3-x}Ba_{3+x}Cu_6O_{14+gd}$
- The $Pr_rY_{1-x}Ba_2Cu_3O_{7-x}$ system
- Thin film transmission measurements
- Raman scattering at large wavelength shifts
- Polarization dependent studies on single crystals
- Can the gap be seen in raman scattering?
- Substitution of 3d materials.

Preprints regarding the points mentioned under 1) can be obtained at the above address. Further information is available through the Bitnet addresses given.

Eberhard-Karls-Universitat Tubingen

Superconductivity Points of Contact:

Prof Dr S. Kemmler-Sack Institut fur Anorganische Chemie Universitat Tubingen Auf der Morgenstelle 19 D-7400 Tubingen (FRG) Phone: 0707/29-2439 /29-6231

Research on High-T_c Superconductivity at the Institute of Inorganic Chemistry of the University Tubingen

The program on High T_c superconductivity spans the area of basic science in solid state chemistry, research on ceramic materials, research on thin films and research on thick films. The program will be developed in collaboration with the group of Prof Gopel, Prof Hubener and Prof Prandl. Interactions with other institutes and industrial contacts are important features of the program.

The basic science field in solid chemistry includes the synthesis of new High T_c materials, the investigation of the crystal structure and measurements of physical properties with the goal of obtaining new materials with still higher T_c and/or better mechanical properties. The research on ceramic materials, on thin films and on thick films is directed to the development of technical applications.

Program Objectives:

a) New High T_c Superconductors

- Synthesis and characterization (crystal structure, chemical analysis, electrical properties, mechanical properties)
- Research in collaboration with groups of physicists

b)Optimization and Application

- Improvement of the chemical resistance
- Optimization of defect structure and grain size
- Preparation of thin films
- Preparation of thick films

Additional information may be obtained by contacting one of the following persons:

Prof Dr W. Gopel Institut fur Physikalische Chemie der Universitat Tubingen Auf der Morgenstelle 8 D-7400 Tubingen

Prof Dr R. P. Hubener Physikalisches Institut der Universitat Tubingen Lehrstuhl fur Experimentalphysik II Auf der Morgenstelle D-7400 Tubingen

Prof Dr W. Prandl Institut fur Kristallographie der Universitat tubingen Charlottenstr. 33 D-7400 Tubingen

/12232

BIOTECHNOLOGY

Hungary: Officials Provide Further News on Biotechnology Problems

Academician Lang on Function of Biotech Council

25020021 Budapest UJ IMPULZUS in Hungarian No 21, 17 Oct 87 pp 40-42

[Interview with Istvan Lang, first secretary of the Hungarian Academy of Sciences, by Anna Varkonyi: "It Won't Work Without Capital", pp 40-41.]

[Text] A number of areas are interested in biotechnology. But without coordinating them there will not be a developed bio industry in Hungary in the 1990's. The development of the bio industry is slow and capital intensive, but what we stint on now we will pay a great price for in the future.

It will soon be 3 years since the Biotechnology Council was formed at the initiative of the minister of industry. They asked Istvan Lang, first secretary of the Hungarian Academy of Sciences, to be chairman and he now answers our questions about how this body, consisting of outstanding experts, can aid the unfolding of the biotechnology economic development target program.

[Question] With what goal was the Biotech Council formed?

[Answer] It offers especially good opportunities for consultation by experts in three large areas—scientific research, technical development and practical work—in regard to industrial and agricultural themes alike. The OMFB [National Technical Development Committee] is coordinating the biotechnology research program; the Biotech Council tries to work out positions and prepare recommendations for practice, for production. Three years ago at the first session of the council we felt that in the present 5-year plan there was need for research and technical development preparation of a longer range national program for biotechnology, although even then it could be expected that sooner or later this theme would be included among the central economic development target programs. In this scientific and technical development preparation we are cooperating closely with the OMFB. The chief of the Protein and Biotechnology Office of the OMFB, U. Pal Kralovanszky, is a member of the council. We have begun to prepare a number of forward looking studies which may serve later as a basis for development of an economic development target program. We have already published joint studies by the Ministry of Industry, the OMFB and the Hungarian Academy of Sciences on the following themes: the status and future developmental possibilities of the microbiological industries, crop production and biotechnology, animal breeding and veterinary medicine. (UJ IMPULZUS, No 25, 1986, described the studies in abbreviated form.) On 1 October we debated a status report on the foodstuffs and pharmaceutical industries; scientific studies of the interdependencies between biotechnology and the machine industry and the chemical industry are in a preparatory stage.

[Question] Was there a research program with which you did not agree?

[Answer] Among the ministry level research guides of the Ministry of Industry the program titled "Long-Range Tasks of Biomass Production and Processing" evoked a conceptual debate. Together with the enterprise contributions this program was disposing of about 2 billion forints, and it embraced a rather broad sphere. The artificial fertilizer and crop protection materials necessary for producing the biomass affect the chemical industry, but certain areas of the agricultural machine industry also have an interest in it; technical development closely connected with biotechnology has an effect on fermentor technology and on fine separation processes in the chemical industry. After the half-time review our basic critical observation was that the program wanted to bring together too broad an area, and as we know he who reaches for much grasps little. We recommended narrowing the program and shifting the emphasis. We supported the ideas pertaining to development of fermentors and setting up experimental plants. The council debated separately the status of making bio briquettes. A fuel corresponding to medium coal quality can be produced by making briquettes out of agricultural wastes, but this is not competitive today because it does not get the same support as coal (only about 80 percent of that), and so today the farms have no interest in dealing with bio briquettes, although we are talking about an existing, large reserve. It is obvious that one should not and cannot contrast the bio briquette question to coal mining, for briquettes come to only 2-3 million tons compared to 25-26 million tons of coal, but it is worth considering as a supplementary source. I hope that the contradictions in this area will end in the future and that there will be favorable preference changes. In any case, support is a question of attitude and of material resources, and perhaps the latter is the more serious obstacle.

[Question] In what areas of biotechnology can one expect the quickest results?

[Answer] The foodstuffs and pharmaceutical industries are the most promising. Expanding variety and improving quality represent progress in the foodstuffs industry. In the pharmaceutical industry there are possibilities for producing a few new products or new types of old products. The third heir apparent is the enzyme manufacturing industry. Today we still cover our enzyme needs entirely from import. The virus immunization program in crop production and reproduction biology in animal breeding hold out possibilities, although they are of smaller proportion. The least spectacular area, but one the development of which is of elemental interest for all of us, is sewage purification. We still turn very little

attention to this, but what happens during sewage purification is also biotechnology, if not so showy as, for example, manufacturing insulin with the aid of genetic manipulation.

[Question] Agriculture, the foodstuffs industry therein (still handled unkindly), industry, the OMFB and the MTA [Hungarian Academy of Sciences] are all involved in biotechnology. Can the council help to concentrate the scattered forces?

[Answer] The members of the council are enthusiastic people who are doing social work because they believe in the cause. In the years ahead they may help much in forming a long-range industrial development policy in which the ratio of the bio industries will be greater than it has been. Of course this could be called structural change too, although I must say that we are not in a position to change structures overnight. The development of the bio industry is a slow, capital intensive process. So fundamental preparation, patience and diligence are important. I do not believe that a biotechnology main authority which would hold everything in one hand would represent a solution. It is true that many organizations are dealing with the question, but this is natural because the interested areas are different too. However, I am still not satisfied with the coordination. Further progress should be made here, and on this occasion I would like to emphasize the readiness of the Academy in this regard. Experts must be trained and every asset must be used to create the objective conditions, because we are constantly losing our positions in the international field. Our backwardness is substantially greater than it was 5 years ago. In the first years of the 1980's we felt a great impetus in ourselves, but soon this will be only a feeling and not a reality. The international field has accelerated greatly and will leave us behind if science and technical development are not given a privileged position, which of course involves not only rewards but also requirements. Without this there will not be a developed bio industry in Hungary in the 1990's. What we stint on this today we will pay a great price for in the future.

Progress, Needs of Godollo Biotech Center

25020021 Budapest UJ IMPULZUS in Hungarian No 21, 17 Oct 87 p 41

[Interview with Dr Sandor Pongor, scientific deputy director of the Agricultural Biotechnology Research Center in Godollo, by Judit Gabor: "Elite Training in Godollo."]

[Text] Recruit ambitious young people interested in technology; teach them what they need to know; offer them opportunities; and if you are satisfied with one another after the years of study establish with them a promising undertaking based on biotechnology! In essence the Agricultural Biotechnology Research Center in Godollo was founded on the above criteria, as we learned from the scientific deputy director of the center, Dr Sandor Pongor.

[Question] Among other things you sought colleagues in the journal HETI VILAGGAZDASAG for your research program to be started in the middle of 1989, setting as a condition that up to then they must participate in a two and a half year training program. Why was this, did you need to experiment with a form of training not previously known here?

[Answer] Looking over the domestic status of biotechnology we found that although several universities included biotechnology subjects in their training program with few exceptions they did not succeed in providing instruction at the appropriate level. This is a branch of science requiring broad, profound knowledge and involving special methodological preparation and approach. Testing the methods requires significant quantities of chemicals coming from capitalist import and at present the universities cannot provide these out of their restricted foreign exchange allotments. Developing the way of looking at things requires a broad but not superficial approach, and this approach is still a shortage item here. Only the journal TUDOMANY makes this specialty accessible to the public. In my opinion we should write many similar textbooks to bridge over the contradictions between the "technological" and "scientific" way of thinking. That is why I considered it an especially fortunate idea when the BME [Budapest Technical University] and the ELTE [Lorand Eotvos Science University] started a biological engineering branch jointly. But the initiative has a weak point—the conditions for practical instruction in molecular biology have not yet developed.

[Question] In the course of their studies so far your students have participated in various types of training. How do they meet your professional expectations?

[Answer] We can measure the professional deficiencies of our students on the basis of university themes and personal interviews. During the two and a half years of training our candidates take a medium level language test and study English and hear lectures on microbiology, genetics and biochemistry among other things, but they must also acquire computer technology knowledge. Laboratory work forms the backbone of the training program; when organizing this we tried to see to it that our colleagues could work in laboratories accepted and certified at the international level. For example, our colleagues working in Szeged work in the laboratories of the Szeged Biology Center of the MTA [Hungarian Academy of Sciences] which represent the world level, surely, and in addition they can hear lectures at the Attila Jozsef Science University in Szeged. And so that the years spent far from their homes should not cause them to fall

behind materially we repay their expenses—for subleasing, travel, language courses. During the training program the participants get a scholarship of 4,500-6,000 forints per month depending on the progress of their studies. At present we have almost 40 colleagues enrolled.

[Question] What happens if one of your candidates does not come up to your expectations in the meantime?

[Answer] When someone joins us we sign a six-month contract with him. When this expires his theme leader can recommend or reject further cooperation. If he is satisfied with him then he can continue his work on a later foreign study trip. This is made possible partly by a loan from the World Bank and partly by the theme leader making use of his international scientific contacts.

[Question] If the actual work begins in 1989 will the training stop then or will you continue the path started?

[Answer] After the run-in period the Center will have to resume its educational tasks. We would like to train experts in a post-graduate form according to a system similar to the present one. We think it would be an optimal solution if some agricultural operation, production system or state farm would send its young workers to us within the framework of an existing cooperation and we would return them as more highly qualified experts with a knowledge of the goal. At present our institute works on a budgetary basis but our goal is the practical use of knowledge. We must solve this in an outstandingly functioning system so that we can cooperate in the most effective way, primarily with agricultural firms. We hope that within a few years information will be provided not only by the researchers beginning now but also by senior researchers who have already met our requirements. They learned biotechnology "on their own" and in general did so abroad. From them we expect that they will be known in international scientific life, that their publications will be known around the world and that their research ideas will turn toward applications within our main guidelines.

Colloquium on Fermentation

25020021 Budapest UJ IMPULZUS in Hungarian No 21, 17 Oct 87 p 42

[Text] On this occasion the meeting of the experts of our biological industry usually held every 3-4 years will be sponsored at the end of this month by the Hungarian Biochemistry Association and the Bio-Engineering Work Committee of the MTA. The organizers have also invited theoretical experts to the Eighth Fermentation Colloquium.

Simply because of the necessarily different viewpoints of theoretical and practical experts we can expect a lively professional debate about the domestic affairs of the fermentation industry, which is developing rapidly throughout the world. The materials of the program will appear in a publication and at the site, in Balatonszemes, the producers and vendors of biotechnology devices will provide product descriptions and displays.

The colloquium undertakes to survey three themes. One of these is the design, development, and operation of bioreactors and the development of control cycles, that is a debate of problems and recent achievements connected with the development of tools for biotechnological activity.

Another area to be discussed in detail is the production and improvement of microorganisms to be used in biotechnological processes. Economic leadership and our public opinion expect a great deal from the gene manipulation technique and its use.

They also want to make public the experiences attained in the design and development of biotechnological procedures. This last theme is organically linked to the preceding two and because of the swift development it is linked to the extraordinarily market sensitive practice. The goal is maximal utilization of the genetic potential of microbes capable of greater and newer output in ever more perfect reaction capabilities (fermenters).

8984

COMPUTERS

Status of Computer Networking in Czechoslovakia

24020006 Prague MECHANIZACE A AUTOMATIZACE ADMINISTRATIVY in Slovak No 9, 1987 pp 322-323

[Article by engineers Peter Oravec and Josef Puzman, CSc.: "Computer Network as a Base for the Intensification of Information Processing"]

[Excerpts] In the CSSR, the effective use of computer technology as a rationalization instrument of all control processes is also constantly scrutinized by the central organs. The debate at the Eighth meeting of the Central Committee of the CPCZ in 1983 and the Fifth meeting in 1987, which dealt with the acceleration of the process of applying scientific and technical development results to practice, underlined the inevitability of a more intensive utilization of the system of scientific, technical and economic information in all areas of our activity.

The packet switching computer networks are one of the solutions to the above stated problems. However, their creation is contingent on the suitable technical and program means and, in terms of building and utilization, on the creation of organizational, legal, economic and sociological preconditions.

Considering the above mentioned current needs as well as securing the long lasting trend of a change to a collective use of computer technology in terminal and mainly computer networks, let us look retrospectively at

the results of the work of the Institute for Applied Cybernetics in Bratislava. Work carried out in recent years has made it possible to gradually create a complex test computer network in the CSSR.

Keeping the overall goal of creating the fundamentals for a theoretical, methodical and technical base for the design and construction of computer networks in the CSSR, the Institute for Applied Cybernetics began working on this project in 1976. The efforts of solving the state plan task for science and technology development (RVT) P 04-521-294 titled "Computer Network for Automated Control Systems" between the years 1976 and 1980 focused on the design and control of computer networks, the development of program systems for a central computer for a data transfer network with packet switching, on the proposal for the implementing of a measuring system for the data transfer network and on the selection of a suitable technical base for computer network elements. At the same time, tasks were being solved pertaining to prognostic and concept work in the construction of CSSR's networks, to the design and implementation of a system of models for computer networks and to the methods of planning and construction. The successful solutions in the individual areas lead to the completion of such projects as the introduction of a developed communication program equipment at the NOTO library and the rendering of methodical instructions for the design and construction of computer networks at the Unified Methodical Base (JMZ) for the Automated Control Systems (1980).

This successful development made it possible to create a packet switching network with a datagram service as a homogenous subsystem of a computer network, designed using only the accessible technology of the System of Small Electronic Computers (SMEP) of Czechoslovak production. In addition to the basic service of the packet switching network—the datagram transfer—the communication program equipment for the nodes also secured a system and assistance service as means of testing, monitoring and maintaining the network. In 1980, for the first time in the CSSR, a three node packet switching network was set up on a testing basis.

In the framework of solving the task of the state plan RVT P 04-521-501 titled "Computer Networks" the research focused on the development and implementation of the system network program and technical means necessary for the construction of heterogeneous computer networks based mainly on the JSEP (Unified System for Electronic Computers), SMEP and others used in the CSSR. The solution was based on the current standards and recommendations of international standardization organizations.

The main planning projects focused on the development and implementation of the network's technical and program devices to connect the peripherals to the packet switching network and to introduce select services for the network users. The results obtained in individual areas were reflected in the gradual creation and implementation of a test computer network with peripherals. In addition to the Institute for Applied Cybernetics, the following participants took part in the design and creation of the test network: Research Communication Institute in Prague, The Center for Scientific, Technical and Economic Information-Central technical base in Prague, Research Institute for Computer Technology in Zilina, University Institute for Computer Technology at the Charles University in Bratislava, the SVST (Slovak Technical University) Computer Technology Institute in Bratislava, the Hydrometeorological Institute in Bratislava, the Institute for Industrial System Engineering in Bratislava and Povazska Bystrica, the Telecommunication Department at the School of Machine Electronics at VSDS (Transportation and Communication University) in Zilina, the Datasystem (special purpose organization) in Bratislava and VUMS (Research Institute for Mathematical Machines) in Prague.

In addition to the cooperation within the CSSR and the bilateral cooperation with the USSR, Bulgaria, Poland and the GDR, a significant multilateral cooperation with the CEMA countries has developed as a part of the activity of the Czechoslovak leading work center at the Joint Section of Specialists for Computer Networks, i.e. the main designers of the JSEP and SMEP.

An extraordinary efforts in solving the task made it possible, as early as 1983, to present at the 33rd International SMEP Test a complex heterogeneous computer network using the JSEP and SMEP elements, making it the first one of its kind in the CEMA countries.

The inevitability to verify and "attain a practical application for the research solution of the computer network" made it necessary to use a number of unconventional approaches, particularly at the beginning phase of the application. In the interest of securing the activity of a maximum, number of network peripherals—terminals as well as computers—it was decided in 1984 to establish a Communication-Information Center at the Institute for Applied Cybernetics. The technical equipment of this center consists of a network node and a concentration of terminals. In view of the available space it was decided to establish 11 terminals. Each terminal, by way of the computer network, has access to all terminals and computers which are connected to the network. The Communication-Information Center gives consultations to the users and trains individuals and groups to work with the network, particularly in the area of obtaining information.

In 1986, after evaluating the two year experimental operation of the computer network of the Institute for Applied Cybernetics, the CSSR Federal Ministry for Communications approved its incorporation into the economic system with covering the costs of the interconnecting circuits. Presently, within the framework of the task of the RVT state plan N 05 titled "Open Computer

Networks", scientists are working on the second generation open network elements based on the multimicroprocessor systems. The objective is to significantly increase the effectiveness of the elements and the network as a whole and to increase the extent of services. Select solutions are included in the CEMA countries' Complex Program of scientific and technical progress by the year 2000. Within the framework of this task the Research Communications Institute in Prague is working on the concept of a CSSR public data network, which would be a significant contribution to the solving of the entire problem.

In 1986, the Applied Consultation Center for Computer Networks was created as a part of the A-08 State Objective Program—the Electronization of the National Economy—by the State Commission for Scientific, Technical and Investment Development, making it a significant step in the development of CSSR's computer networks. This joint center of the Institute for Applied Cybernetics in Bratislava and the Institute for the Use of Computer Technology in Administration in Prague oversees the processes of designing, establishing and use of computer networks in the framework of the CSSR's national economy.

Until now, the designed network devices and their use have not been the final solution. They are, in fact, results of the research, development and the use of the first generation of devices for the construction of global computer networks in the CSSR. Using the operation experiences, the networks continue to be optimized and modernized using the latest results of the international standardization activity and they are being enlarged by the new services available to the users. The second generation of the network elements is the result of trying to meet the user's demands for better parameters of the network elements, keeping in step with the development of network application.

At the same time it is necessary to mention one serious aspect of the problems connected to the development of CSSR's computer networks. A characteristic feature of the computer networks it he complexity of the problems associated with both the construction and the use of the networks. That means that it is necessary to solve problems associated not only with technical and program securing of the networks but the corresponding economic, legal and organizational issues as well. In some cases, particularly in connecting to computer networks abroad, poliltical issues must be considered as well. A delay in their solving can, in the near future, significantly decrease the effects of new progressive technology of network communication, mainly in the area of the utilization of information sources and integration of control systems at all levels of the national economy.

12993/9738

Overview of AI in CEMA

24020006b Prague VYBER INFORMACI in Czech No 4, 1987 pp 452-454

[Text] The goal of the next-generation computer system project is to create a plan for a priority basic and applied research and development for computer technology and data processing at the various Academies of Science in socialist countries. Together with the industrial research and development plans this plan would create a unified entity. As the primary subject, the new computer system generation project is incorporated into the priority "Electronization" program of the CEMA countries' Complex Program for Scientific and Technical Progress by the year 2000. The project focuses on the creation of a complex data processing system, the CAD/CAM of the computer systems and microelectronics for solving the most difficult tasks in the area of programming technology and developing the artificial intelligence theory. It also focuses on introducing a common area for the most effective utilization of computer technology and data processing means in the national economy of socialist countries.

The above described basic and applied research is developing in a form of complex scientific projects of international research groups. These groups work in international basic laboratories at various institutes of the Academies of Science in socialist countries. The following ten points are the overview of ten complex scientific projects (KVP) divided into subprojects:

1. Data Processing Systems: (Expert systems; Basic data processing means; Computer data processing systems; Distributed data base systems; Dialog in natural language; and Data base computer)

2. Screen Processing and Computer Graphics Systems: (Creation of highly accurate and effective digital screen processing systems; Creation of systems for real time screen processing; and Creation of computer graphics systems)

3. Systems for Automated Designing of Computer Systems: (Copy and model systems for computer design; Analysis of theoretical basis for designing integrated circuits VLSI and ULSI)

4. Computer Networks: (Local computer networks; Technical and program means for network processors; Intelligent terminal networks; Distributed data processing)

5. PC Systems: (Designing the new generation of PCs; Researching the PCs for solving artificial intelligence tasks; Developing the man-computer interface)

6. Failure Resistant Computer Systems: (Automated diagnosis of the computer technology capabilities; Organizational principles of the failure resistant systems interrelations; Designs and methods of securing failure

resistance; Algorithms and programs for reliable computer systems; Designing reliable implementation computer systems using plate integration [WSI])

7. Collective Memory: (Collective memory on the basis of a multilayer media with optical recording and electric amplification; integrally optical collective memory; Hierarchical holographic collective memory: Association collective memory, Multilayer quartz collective memory, Cylindrical magnetic bubble collective memory, Device for recording digital high density data, Data protection in the collective memory)

8. Programming Technology: (An experimental system of an automated design, creation and introduction of programs for the new generation PCs; Developing methods of increasing the reliability of computer program capabilities; Technology of creating programs for computers and system designs)

9. New Algorithms for Data Processing and Design: (Development and improvement of methods and mathematical modeling technology and computational experiments; Developing methods for support programming for analysis and filtration of processes in stochastic systems; Designing high efficiency systems and data flow computers (DF); Parallel calculations algorithms)

10. Data Processing for Teaching: (Creating models for teaching processes; Design R&D for teaching and educational processes; Equipping experimental centers for educational data processing).

VI. Conclusion

From the above described overview it is apparent that following the Japanese initiative in 1981 there has been an avalanche of research and development projects for the new generation computer systems, through which intertwines the artificial intelligence and data processing theory. Taking into account the extremely large financial and human resources invested in these projects, it is realistic to assume that by the beginning of the nineties significant results will have been reached on the road to the new generation of computer systems.

12992/9738

Hungary: Four Developments From Computer Technology Institute

25020022a Budapest
COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 22, 4 Nov 87 p 5

[Unsigned article: "New Items From SZTAKI (Computer Technology and Automation Research Institute)"]

[Text] Four new developments have been prepared in various departments of the Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences.

A program system aiding software design and documentation has received the name SODOMA, perhaps referring to domestic conditions reigning in this area. Since the large computer systems of this type which can be found on the world market are too general and thus clumsy, the developers took as a goal specifically the development of a system serving the design and documentation of industrial process control systems. The system, written for the TPA series and Motorola based computers, may aid the work of manufacturers of domestic process control equipment.

CRDB (Core Resident Data Base) supports the automation of already functioning process control systems. The most essential property of these systems is real-time operation and the requirement following from this is a strict requirement regarding data access time. With a database manager remaining in memory and combining the reviewability of traditional database managers and the speed of common access data areas they succeeded in attaining access times under 0.5 milliseconds in an RSX operating system.

The EDMAP general purpose map editing program and the SHIVA form management system operate on smaller machines, on IBM PC's. The latter can be linked to the already known LATOR database manager and thus the user can work on forms developed by himself.

The new items will be shown for the first time on the occasion of Software'88.

8984

Hungary: Software Demonstration at Sopron

25020022c Budapest
COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 22, 4 Nov 87 p 11

[Article by Marton Vargha: "Software Demonstration at Sopron"]

[Text] A program, software, has a big problem—it cannot be put on display. There are demonstrations or trial runs but in general these show something only to one who knows the product, knows what is happening inside the computer. So it is better not to organize an exhibit but rather a meeting providing an occasion for a lecture, for a detailed verbal—or written—description. Such an occasion was the MSZR [uniform minicomputer system] software meeting of the Szamalk [Computer Technology Applications Enterprise] OSAK—National Software Archives and Tracking Service—held this year for the sixth time.

As our readers surely know the MSZR is the CEMA minicomputer system organized on the pattern of the ESZR [uniform computer technology system], which corresponds to the DEC PDP computer family—and the

Hungarian TPA. So the software meeting serves primarily owners and users of the domestic MSZR machines—the SZM 4 and SZM 1420—but following an announcement last year it was of interest to others as well this year.

Following the domestic spread of the IBM XT and AT microcomputers, a spread which is also supported centrally, there is beginning to be software import too. And the OSAK found a partner, Microsoft. Hereafter, with the authorization of the Ministry of Foreign Trade, firms dealing with software export, or more precisely with the export of software experts, can import program products out of half of their annual foreign exchange income increment.

So hereafter the OSAK will sell Microsoft software in addition to domestic, Soviet and Bulgarian program products. It is true that they will do so rather expensively, as many have noted on the basis of the advertising leaflet. Nikifor Mihajlov, chief of OSAK, has tried to reassure them: "This is only a guide, the price will probably drop a good bit."

We could not see the Microsoft programs in operation but we could see many others and we heard talks about them.

First of all we should mention the Soviet linear and nonlinear operations research program packages, which should be of interest to owners of an SZM 1420. The program packages can handle optimization tasks with 100 lines and 250 variables.

Another Soviet offering, the Setor database manager, is already known in Hungary. It is so well known that Kalugin, who described the program in his lecture, was forced later to deal with the user complaints which have come up already. As a true-born systems programmer he rejected a good number of the complaints by saying that those complaining were incapable of saying precisely what and where the error was, and could not reproduce it. "There were a few errors which could be attributed to minor clerical errors in the documentation," Kalugin said of another group of errors. Finally he mentioned two errors which were really errors—that is, were so even according to him. Of these one may be interesting because it appeared from Kalugin's analysis that they were incapable of producing the phenomenon at home, they could not imagine the use or load which they then found here with the party complaining.

Unfortunately the lecture which was intended to call the attention of the participants to DIAMS, in Hungarian this is the UNIX operating system, did not take place. I learned from the lecture summary, which fortunately was available in writing, that this operating system has existed for SZM computers since 1982!

The meeting was also an occasion for face-to-face meetings of those maintaining SZM computers and the operators suffering from the failures. Rumen Sztojanov, chief of the small computer main department of Szamalk, characterized the situation as follows: "Parts supply is in a peculiar situation in CEMA—on paper. At the end of 1985 the foreign trade standing committee issued a document according to which one could order parts with three degrees of urgency, including a one-day order. But if the Bulgarian made peripherals of our SZM machines, made in Czechoslovakia, break down then we can request the part only from the Czech partner."

The Bulgarian peripheral manufacturer is not obliged to ship the part directly to Szamalk, with which he has no contractual relationship, and he does not ship it.

Not counting parts supply the machines—especially the SZM 1420—are reliable and service works well, as appeared from the comments of a few users.

Microcomputer software was not limited to the products of Microsoft already mentioned. There were, for example, several Bulgarian manufacturers offering, among other things, office automation and CAD programs for XT and AT type machines. Videoton offered the Clipper compiler program which can be used for dBASE.

Speaking to experienced dBASE III users their test demonstrating the relative speed of a compiled program seemed convincing.

A reassuring conclusion could not be reached in the informal conversations, the chief theme of which was the difference between legally and illegally distributed user programs. Michl Reiner, the representative of Microsoft, rather aggressively represented the view that legal action should be taken against illegal copying. Miklos Havass, director general of Szamalk and first secretary of the NJSZT [Janos Neumann Computer Science Society], recalled that according to estimates an average of 10 copies are made from programs sold in the United States and that the trade in illegal copies, in violation of copyright, in the Far East is higher by an order of magnitude than in Hungary. The unhealthy ratio between software and hardware prices also came up in the debate, something which encourages the Hungarian user to steal.

There is no doubt that with the growth of the user camp the copyright protection of software will become more important than it has been and there should be a debate about it. But it would be a vain dream to believe that it will ever be realized perfectly.

8984

LASERS, SENSORS, OPTICS

Hungary: Laser Research in Szeged

25020011 Budapest FIZIKAI SZEMLE in Hungarian No 7, 1987 pp 257-261

[Article by Gabor Kovacs, Janos Hebling, Bela Racz and Zsolt Bor, Experimental Physics Faculty, Attila Jozsef Science University: "Laser Physics Research in Szeged I; Nitrogen Lasers"]

[Excerpts] 1.4 The First Domestic Nitrogen Lasers

In the fall of 1973 it was decided at the Experimental Physics Faculty of the Attila Jozsef Science University that a nitrogen laser should be developed to excite dye lasers. The first domestic nitrogen laser was in operation in January 1974 and was exhibited in May at the Budapest International Fair. Figure 4 shows the operation of this laser. The high voltage pulse generator was a Blumlein generator built up out of flat feed lines.

The K switch seen in Figure 2 a was an electrically triggerable (startable) spark circuit so formed that it could switch a current of 10 kA.

As can be seen, we selected the technically simplest solutions, ones for which domestic production caused no difficulty. The energy around 1 mJ obtained at a repeating frequency of 10 Hz was sufficient to perform a number of dye laser experiments, but considering the reliability of the system and the stability of the pulses it could be regarded only as a reassuring beginning and it had a few disadvantageous properties.

We began broad studies to eliminate these disadvantages and develop an optimal exciting system. We did not find such studies in the literature; the chief reason for this was the industrial importance of the results, and even our own studies were recorded only in our 1977 and 1978 reports prepared for the National Technical Development Committee. On the basis of these we used a discharge tube arrangement the cross section of which, with the condensers, is shown by Figure 5, with the gas pressure characteristics of some typical output energies (Figure 5 b).

In the N_2 laser design shown in Figure 4 the spark gap was suitable for switching current of the necessary magnitude, but it could not be started reliably. This increased the energy scatter of the laser pulses and ruled out the possibility of having the unreliability of the laser switching time being smaller than 10 ns for even only a few pulses. We were able to solve these problems by using a hydrogen filled thyratron in place of the spark gap.

The arrangement shown in Figure 4 was developed further with the modifications described above so by the end of the 1970's we had developed a low pressure nitrogen laser type which operated reliably, and the operation of it did not require physics expertise. So not only could we use this laser type to excite a dye laser but it was also used at a number of research sites in the country by non-laser experts in the course of their own experiments. The middle column of Table I shows the characteristic parameters of this laser type.

Table I

	Low Pressure	Atmospheric Pressure (TEA)
Wavelength (nm)	337.1	337.1
Bandwidth (nm)	0.12	0.08
Pulse energy (mJ)	1.5	0.2
Pulse duration (ns)	6-8	1.0
Pulse power (kW)	250	200
Pulse repeat frequency (Hz)	0-50	0-50
Dimensions of beam (mm)	6 x 20	1 x 3
Divergence (mrad)	1.5 x 6	2 x 10
Energy scatter	plus/minus 4	plus/minus 6
Jitter	less than plus/minus 2 ns	less than plus/minus 2 ns

The first atmospheric pressure nitrogen laser was prepared in Szeged in 1978. (These are often called TEA lasers after the abbreviation of the English words "transverally excited atmospheric".) A Blumlein generator built up out of flat feed lines and switched with a spark gap served to excite this laser but by 1979 a thyratron was the switching element in place of the spark gap. The most important data for this laser are contained in the third column of Table I.

Comparing the parameters of the low pressure and atmospheric pressure nigrogen lasers we can see that although the energy of the light impulse of the low pressure laser is significantly greater than that of the atmospheric pressure laser there is no significant difference in peak power because of the different pulse lengths.

1.5 Developmental Achievements of the 1980's

So as the 1970's turned into the 1980's we had developed two basic N_2 laser types which could be used in a broad area. A number of examples of these types are being used in various research institutes and hospitals in the country and a few examples are even used abroad. On the basis of the experiences of users of the lasers (including our Faculty) there were increased demands on the N_2 lasers—to increase the output energy, to improve the stability of the energy of the laser, and to reduce the unreliability (jitter) of the appearance time of the light pulses relative to the triggering electric signal and to reduce the electric interference radiation of the device. Only after such developments could they satisfy the requirements presented by, for example, the magnetic bubble memory studies done at the KFKI [Central Physics Research Institute]. These studies required two independent 100 ps light pulses; the delay between them had to be varied between 0 and 1 microseconds; and the set value of the delay had to stay in the neighborhood of 500 ps for several hundred flashes.

The two existing basic N_2 laser types had to be optimized to satisfy the new requirements. First we made changes in the high voltage pulse generator of the laser. We used a capacitance transfer generator in place of the Blumlein generator because according to experience one can get greater light energies with these. According to calculations the best efficiency (the quotient of the light energy and the electric energy fed in) can be obtained if the ratio of the capacitance of the condensers is $C_1/C_2=1$. We made a change in the circuit starting the thyratron. As a result of this the jitter of the laser decreased to a great degree.

The switching delay of the laser is influenced by a number of factors which change slowly in one direction with time constants of seconds or minutes. The most important of these are the pressure of the active gas, the high voltage and the temperature of the thyratron. With a suitable automatic system one can see to it that the time between the starting signal of the laser and the light pulse remains at a constant value. Figure 6 illustrates the principle.

For every pulse a start-stop circuit measures the delay between the starting pulse and the output signal detected by the photodiode. If the delay increases or decreases it gives an output signal with the proper sign and with an amplitude proportional to the change. A voltage delay converter increases or decreases the delay so that the delay for the next pulse will again be at the original value. A jitter showing a basically statistical distribution cannot be decreased in this way but one can significantly decrease the long-term change (see Figure 7).

In Figure 7 the measured switching time is shown on the horizontal axis and the number of pulses for individual times is shown vertically. It is worthy of note that the measurement was done over more than 30 minutes!

A significant part of the development consisted of studying and suppressing the electromagnetic interference radiation arising in the laser. We succeeded in developing a shielding design with which the interference radiation of the laser was reduced to negligible amounts from the viewpoint of practical use.

We did research aimed at improving the parameters of the TEA nitrogen laser. In the course of this we used the optimizing procedures already used in the low pressure nitrogen laser. In this work we turned special attention to a study of the ionization of the N_2 gas before discharge, for without this one cannot create stable laser operation in the higher pressure range. With a special solution for pre-ionization we succeeded in developing a new nitrogen laser operating stably in the medium (30-50 kPa) pressure range. The medium pressure nitrogen laser combines the advantages of the low pressure and atmospheric pressure nitrogen lasers. This is because of the relatively large energy and short pulse by virtue of which its peak power surpasses the peak power of both the low pressure and atmospheric pressure lasers.

Table II contains the most important parameters of the low, medium and atmospheric pressure nitrogen lasers developed as a result of the changes outlined.

Table II

	Low Pressure	Medium Pressure	Atmospheric Pressure
Pulse energy (mJ)	3	1.7	0.1
Pulse duration (ns)	6	1.6	0.7
Pulse peak power (kW)	500	1060	140
Pulse repeat frequency (Hz)	0-50	0-50	0-50
Dimensions of beam (mm)	6 x 20	4 x 8	2 x 3
Energy scatter (%)	plus/minus 0.4	plus/minus 0.5	plus/minus 1.0
Jitter (ns)	plus/minus 0.1	plus/minus 0.1	plus/minus 0.1
Interference*	less than 0.3	less than or = 0.3	less than 0.3

*Interference in mV measured with a 1 cm^2 loop 0.5 m from the laser.

It can be seen that the energy of the low pressure laser increased significantly, the pulse length of the atmospheric pressure laser decreased and the peak power of the light of the medium pressure laser exceeds 1 MW. Even more significant for most users than these advantageous changes is the large energy stability and small jitter of the lasers. The small interference radiation is also very important for it makes it possible to use the laser as part of a complex, highly sensitive measurement system.

The nitrogen lasers made in Szeged can compete with any foreign nitrogen laser in regard to energy stability and jitter. If a user needs a light pulse with properties like those produced by a nitrogen laser (high power, short, ultraviolet) but if the energy must be on an order of 100 mJ then he must use an excimer laser. This high energy type of a pulse operating gas laser began to operate in Szeged in 1985 for the first time in our country. We will write about this type of laser in our next issue.

Figure Captions

No 2. a and b, p 258: High voltage pulse generators suitable for exciting nitrogen lasers.

No 4, p 259: Structure of the first domestic nitrogen generator.

No 5, p 259: A nitrogen laser fed with pulse condensers (a) and its characteristics (b).

No 6, p 260: Block diagram of a nitrogen laser with actively regulated delay.

No 7, p 260: Typical distribution of the jitter of a nitrogen laser with actively regulated delay.

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MICROELECTRONICS

Hungary: REMIX Development Policy, Surface Mounting Plans

25020012b Budapest MAGYAR ELEKTRONIKA in Hungarian No 9, 1987 p 3

[Interview with Janos Goblos, technical director of REMIX, by Bela Laczko]

[Excerpt] [Question] We know that you are one of the advocates of the adoption of surface mounting technology (SMT) in Hungary. We would like to know what steps REMIX has taken thus far in connection with this and what experiences users have had. What sort of interest or approach has there been?

[Answer] We got the first serious technical information—primarily from the West—in 1985, nearly two and a half years ago. We said in 1985 that the equipment manufacturing industry would have to convert to this new technology very quickly. So we proposed setting up a model plant and REMIX assumed the "system patron" role for this theme. In 1986 we held open days on at least 30-35 occasions and 200-300 engineers studied the technique from layout design through parts assortment and automatic assembly devices to the plant procedures. So far we have not succeeded in teaching our engineers who are designing circuits to think in the new technology. It must be seen today that a domestic introduction of the surface mounting technology is not only a question of capital and investment, we must also create an intellectual background for it. Although university and college instruction caught up quickly and the freshly graduated experts have the necessary basic information, the designers and technologists working in industry have not yet moved noticeably in the direction of SMT. The license purchases by Videoton and Orion will mean some movement from dead center, they will use the surface mounting technology in these licenses.

The situation with SMT today is similar to the beginning of the manufacture of hybrid circuits, at the end of the 1960's. Manufacture of them went up to 10 million forints from 1969 to 1975 and today hybrid circuits make up a value of about half a billion forints, a respectable part of domestic microelectronic parts use. We have to hope that this will be the situation with the introduction of SMT.

I am convinced that in the near future anyone who cannot exploit the advantages provided by SMT will be forced out even of the markets existing today. In 1988 we will begin manufacture of MELF type surface mountable resistors. Acquisition of our chip condenser manufacturing line is also awaiting authorization. We intend to contribute to the introduction of SMT with these two lines.

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Hungary: Leading Electronics Firms Rated

25020002 Budapest COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 16, 12 Aug 87 p 4

[Text] Each year the economic policy weekly FIGYELO publishes various economic indexes for the one hundred Hungarian Industrial enterprises putting out the greatest production value. (In 1986 the enterprises belonging to the "hundreds' club" provided 56 percent of the production value of socialist industry.) In our gleaning we were curious as to where the manufacturers of electronic and computer technology products placed in the ranking of large industrial enterprises in the mirror of statistical data (FIGYELO, No 29, 1987). We feel that citing the listing from this unique viewpoint is instructive even without commentary. (The entry "—" means that the enterprise does not appear in the "hundreds' club" on the basis of that index.)

Table of Rankings

Name of Enterprise	Rank/production value, 1985	Rank/production value, 1986	Production value limit (billions of forints)	Personnel	Rank-/gross fixed assets, 1986	Rank/export sales, 1986	Domestic sales	Net, sales receipts proportional, 1985	Net, sales receipts proportional, 1986	Profitability rank/enterprise gross profit per 100 forints gross work income, 1986	Per 100 forints assets tied up
Videoton Electronics Enterprise	9	9	10+	2	34	3	31	5	6	23	4
BHG Communications Engineering Enterprise	57	41	5-10	14	86	23	84	1	7	40	11
Medicor	46	47	2-5	20	93	17	—	32	32	61	38
Orion	83	59	2-5	49	—	86	58	41	35	49	34
MOM [Hungarian Optical Works]	67	63	2-5	21	77	27	—	3	5	37	10
Machine Tools Industry Works	77	67	2-5	44	92	31	—	17	14	35	17
Microelectronics Enterprise	76	80	2-5	50	63	39	—	14	60	82	72
Telephone Factory	—	83	2-5	45	—	25	—	—	2	26	7
MMG Automatic Works	87	88	2-5	39	—	56	—	4	1	18	5
RRG Mechatronics Enterprise	—	100	2-5	68	—	26	—	—	3	19	2

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SUPERCONDUCTIVITY

Ultrapure Materials for Bulgarian Electronics

22020004 Sofia SPISANIE NA BULGARSKATA AKADEMIA NA NAUKITE in Bulgarian No 4, 1987 pp 29-35

Article by Professor Elena Kirkova: "Ultrapure Materials for Electronics: Outlook and Problems"]

[Text] After World War II, and especially during the last two decades, there has been a very rapid development of various branches of electronics such as semiconductor electronics, quantum electronics, optoelectronics, and others. Ultrapure materials with total impurity content from 10^{-3} to 10^{-4} percent and as little as 10^{-7} percent for each type of impurity are necessary for their development. Solid impurity particles measuring one micron or less are especially important when dealing with liquid and gaseous substances, as well as with solutions which are widely used in electronics. These are the so-called substances with MOS purity (Metal-oxide semiconductor)[in English in the original]. Superpure substances with impurity content of as little as 10^{-10} percent for each type of impurity have been obtained for use in optoelectronics during the last 10 to 15 years. Theoretically, we should be able to obtain substances with impurity concentrations of 10^{-17} to 10^{-18} percent. In practice, however, this cannot be achieved mostly because of insoluble solid particles which are introduced into the substances while they are undergoing crystallization from solution, fusion, or the vapor phase.

The Status of and Problems with Ultrapure Materials for Electronics During the present 5-Year Plan and Through the Year 2000

1. Semiconductor Electronics[1]

Production of ultrapure materials for semiconductor technologies over the next 15 years will increase by 20 percent per year. This percentage is greater for microelectronics; it is about 25 percent because microcomputers are used more and more in the different sectors of technology and everyday life. The greatest percentage, about 44 percent, goes to the production of substrate materials. At the present time, 95 percent of substrate materials used are silicon single crystals. The remaining 5 percent are germanium, gallium arsenide, and indium phosphide. Gallium arsenide and compounds of the type A^{III} B^{V} in general, are characterized by great current carrier mobility and semiconductor devices on the basis of these compounds operate at much higher frequencies than silicon devices. The technique used in growing single crystals of phosphide compounds, however, is hampered by the high vapor pressure of phosphorus at the melting point of the phosphide compounds. On the other hand, a good quality interface semiconductor or dielectric cannot be obtained from natural oxides of $A^{III}B^{V}$ compounds because the oxides of the group V elements are volatile. The problem here is to layer the surface of the substrate material with additional dielectric such as $Si0_2$, Si_3N_4, Al_20_3, and others. Small quantities of remaining natural oxides, however, affect the interstitial dielectric surface.

Photoresists comprise 6 percent of all materials used in semiconductor technologies. There are two types: positive photoresists such as: polyisoprene, epoxy butadiene [furfuran], and polyglycidyl methacrylate, and negative photoresists such as: polymethyl methacrylate, polysulfonates, and others. Photoresists which have been used up to the present time have been mostly of the negative type. In the future, the pro-portion of positive photoresists used will increase because they permit the use of cheaper developing solutions.

Wet chemical processes consist of a number of steps such as cleaning the wafers, skimming, developing the circuit, removal of the protective coating, etching, doping process, and others. They take up about 9 percent of the chemicals used in the semiconductor industry, but the number of different types is the greatest: 65 organic substances and 20 inorganic solvents and solutions, in addition to the same number of various activators. The greatest problem with these liquid reagents and inorganic solutions is MOS purity because small, sub microscopic solid particles trapped between two bands serve as a bridge for electron transfer which leads to integrated circuit process disruption. The smaller the size of the computer, the more undesirable these solid particles are in the chemical reagents used for wet processes. For this reason there is a tendency to replace some of these processes such as, for example, etching, with a laser-assisted plasma process.

A large part (about 41 percent) consists of packaging materials. Of that, 17 percent is true packaging which at the present time is made of plastic materials. In the future it will be replaced by ceramic packaging because the temperature coefficient of expansion of the ceramic material is similar to that of the silicon substrate. It is also a better insulator than plastic and ensures a better hermetic seal.

Paste, which represents 9 percent of packaging materials, is used in copying hybrid circuits. It contains precious metal which makes the product more expensive. The problem is to find a cheaper metal which could replace precious metal wholly or in part. The preparation of printing plates used in microelectronics involves layering a highly reflective copper coat over a filler-reinforced epoxy resin substrate. This is accomplished by nonelectrolytic electroplating for which solutions of $Cu_2P_2O_7$, $Cu(HSO_4)_2$, and $Cu(BF_4)_2$ are necessary. The removal of the unnecessary copper is done with solutions of $FeC1_3$, $CuC1_2$, NH_4OH, $(NH_4)_2S_2O_8$, and HF_2SO_4+H_2O. Photoresists, developers and solvents, protective inks, various etchants, adhesives, and others are also needed here.

2. Quantum Electronics

Quantum electronic or laser materials have the ability to generate and amplify electromagnetic waves. They are dielectrics in the solid, liquid, or gaseous state, doped with activating ions such as: Cd^{2+}, Ni^{2+}, Cr^{3+}, Fe^{3+}, Nd^{3+}, U^{3+}, and others. Oxides of the elements from groups II, III, and IV, tungstates and molybdates of some metals, fluorides of the elements from groups II, III, and VII such as CaF_2, BaF_2, LaF_2, MnF_2, and others are used for solid-state lasers. Fluorophosphate glass activated with Nd^{3+}, Tb^{3+}, Yb^{3+}, or Gd^{3+} is also used for solid-state lasers. Yttrium aluminum garnet ($Y_3A1_5O_{12}$(YAG)), doped with Nd^{3+} and calcium fluoride (CaF_2) activated with U^{3+} or a rare earth element with a +3 valence produce the most active solid-state lasers. A new generation of lasers with high efficiency performance coefficient is presently being developed using different types of garnets.[2] A sensitization effect is used which is characterized by nonradiative energy transfer from the sensitizing ion to the activating ion. The experiments involving heterovalent isomorphic substitution of the two trivalent elements in garnets by one bi- and one quadrivalent element, for example with Ca, Zr, or Mg, Zr, are interesting.[3,4] In this case, Zr is the activator, while Ca and Mg are used to compensate for the electric charge and for increasing the efficiency of the co-crystallization of zirconium. Chrome activated alexandrite ($BeAl_2O_4$:Cr) is a promising solid-state laser

material.[3] The problem here is to obtain crystals without dislocations using Czochralski's method because the different crystal sectors grow according to different mechanisms.

Compounds of some rare earth elements, such as the silicates and germanates of the apatite type $Ln_2O(SiO_4)$, aluminates of the perovskite [unable to find in my references] type LnAlO
$_2$, garnets $Ln_3Al_5O_{12}$, orthophosphates LnPO
4
, and polyphosphates are promising solid-state laser materials.[3]

Single crystals with compositions such as, for example, $La_{(1-x)}Nd_xP_4O_{14}$ or $MeNd(PO_3)_4$ (where Me=K, Rb,Cs), when compared with better known solid-state laser materials, have the following advantages: a high concentration of the active ion (3.4 to 3.8 x 10^{21} atoms per cm^3), which is a factor of 10 greater than the concentration of this ion in YAG:Nd^{3+}, and a longer period in the excited state for Nd^3 as compared to that of YAG (310 and 230 microseconds respectively).[5] All this permits the construction of miniature lasers with thin layer configuration.

Solutions of diketones of rare earth elements in organic solvents, solutions of fluorescent organic dyes, solutions of inorganic compounds of rare earth elements, and others are ultrapure materials for liquid lasers. Cu and Mn vapors, inert gases (He, Ne, Ar), CO_2, and others are used as active media for gas lasers.

The problem with laser materials is finding substances which lase in the shorter wavelength portion of the spectrum, since, up to now, powerful laser systems operate only in the initial infrared portion of the spectrum. Experiments aimed at developing an X-ray laser, which could be used to obtain holograms of cells and molecular structures and make semiconductor microcircuits, are interesting in this respect. Such a device based upon a greatly excited yttrium (λ+155A) and selenium (λ+209A) atomic plasma requiring an enormous amount of energy. The mirror used to amplify this laser beam consists of alternating layers of molybdenum (35ßDA) and silicon (60ßDA).

In order to use laser beams effectively they must be regulated. This is expressed as change in their parameters: amplitude of the beam, frequency, phase, and polarization vector. This is accomplished using single crystals of a substance, called modulators, which exhibit an electroptical effect. The most commonly used laser beam modulators are KH_2PO_4**(KDP)** and $KH_{2+}AsO_{+4}$. When the potassium in these compounds is replaced by NH_4 Rb or Cs and the hydrogen is replaced by deuterium, the electroptical properties of the crystal are improved. Single crystals of α-$LiCo_3$, $LiNbO_3$, and $LiTaO_3$ are also used as laser beam modulators. The problems yet to be solved regarding the quality of these crystals are as follows: crystals of the family of KH_2PO_4 are deformed in the presence of small quantities of trivalent impurity ions such as Al^{3+}, Fe^{3+}, and Cr^{3+}. For this reason, the output material must be of very high purity. Work toward eliminating trivalent impurities from KDP and DKDP is hampered by the lack of a highly sensitive method to analyze these impurities. This method must be fast and accessible to industrial laboratories.

The second problem is growing large size single crystals with cross sections measuring up to 1 m^2. These crystals are used as frequency converters. At this time large KDP and DKDP crystals are produced only in several laboratories in the world.

Lithium iodate is mechanically stable and heat resistant over a wide range of temperatures (20ßD to 247ßDC) and is a very good YAG:Nd^{3+} laser beam converter. The problem is to obtain perfect single crystals without alkaline inclusions which release free I_2 during laser beam photolysis which, in turn, decreases the optical activity of the crystal. New types of crystals are being sought for use as optical converters. Crystals of the groups of $KTiOPO_4$(KTP), $RbTiOPO_4$(RTP), and $TlTiPO_4$(TTP) look promising. Experiments using these crystals started about 10 years ago and are now in the process of being organized for mass production. Of the water soluble electroptic crystals, the double formates, for example, $NaCd(HCOO)_3$ and $BaCd(HCOO)_4$, look promising.[6]

The high power CO_2 laser operating in the infrared range has been widely introduced for use in the industrial processing of various materials with low melting points. KDP crystals are used as frequency converters because they are transparent over a broad spectral; however, their efficiency is comparatively smaller for these beams. single crystals of alkaline halides are promising frequency converters for CO_2 laser beams. The problem with OH- groups is difficult to solve even for crystallization from a melt in an active medium of the corresponding halogen elements. For this reason, there are experiments for obtaining optical polycrystalline material by compressing pulverized alkaline halides obtained by vaporizing the salts in a dry argon medium.

Several reports, mainly by French scientists, were presented at the last conference on crystal growth in York. They represented the outlook for some organic crystals as laser beam modulators.

3. Optoelectronics

Optoelectronic materials transmit light signals. These signals are received and transformed into electrical signals which are later amplified by ordinary transmitters. We will dwell briefly only on matters concerning optical fibers or optical waveguides which, during the present 5-year plan and through the year 2000, will largely replace metal conductors used in communications

equipment, television, digital and analog data transmission, etc., and on the basis of which new methods of medical treatment, new industrial technologies, and others will develop. At present, quartz optical fibers made of silicon dioxide are most commonly used. They are obtained using vapor phase synthesis with $SiCl_4$, $GeCl_4$, $POCl_3$, and BBr_3 as liquid reagents. Impurities such as 3d elements, OH- groups, and submicroscopic solid particles are very bothersome. The lower the concentration of such impurities, the lower the optical losses, thus, the range and speed of data transmission are increased by the same factor. Quartz optical fibers have minimal losses of 1.10^{-1} dB/km. Optical fibers obtained from group VIA elements and those from various fluorides have lower optical losses: 1.10^{-2} dB/km and 1.10^{-3} dB/km respectively. The former are synthesized from the sulfides, selenides, and tellurides of Ge, P, and As, and the latter are synthesized from the fluorides of Ba, Al, Zr, and Hf. The synthesis of fluoride waveguides is exceptionally difficult because of the high melting point of metal fluorides, their volatility, and their highly corrosive properties.[7] They are very useful, however, in long distance data transmission.

Optical fibers for the infrared range are of interest for medical and other purposes. These fibers are obtained on the basis of polycrystalline silver halides. The core is made of AgBr and the coating of AgCl. If these halides are single crystals, the optical loss of the fibers decreases greatly and they can be used over a wide range of the infrared spectrum (2 to 20 mkm). The experiments to obtain a hollow optical fiber using GeO_2 are of interest. The advantage of such a fiber is that a high power laser beam can pass through it, whereas such lasers would melt the core of other fibers.

Electroacoustics

Electroacoustics is that part of electronics which deals with the interactions between electron currents and single-crystal lattices with piezoelectric and semiconductor properties.

Crystals of ZnS, ZnO, CdS, CdSe, InSb, GaAs, $Bi_{12}SiO_{20}$, $Bi_{12}TiO_{20}$,and others are of this type. This interaction amplifies ultrasounds generated by, for example, a quartz wafer, dozens of times. In addition to amplification, piezoelectric semiconductors can generate ultrasounds using electron currents. The converse effect is achieved when acoustic waves passing through a piezoelectric semiconductor transmit part of their momentum to the electron current, thus generating a potential difference at the edges of the piezoelectric semiconductor. Electroacoustic current is produced when the chain is completed. We will be incorporating all these phenomena, found in electroacoustic devies, more and more into our practice.

The Development of Scientific Research and the Attendant Effort Toward Obtaining Ultrapure Materials for Electronics[8]

Obtaining ultrapure materials is a fundamental problem in the development of electronics. Furthermore, from ultrapure we are gradually moving toward superpure materials. It is considered that increasing the substances' purity will not only improve their electric, physical, and optical properties, but that new, as yet unknown, properties will be discovered which will increase our knowledge of the nature of matter. In this respect, the production of ultrapure and superpure materials has become a separate scientific and technological problem with its own objectives, goals, and research methods.[9]

The goal of scientific research is to develop the old classical methods for purification such as recrystallization, sorption, the electrochemical method, extraction, distillation, rectification, and others, and to seek new, more effective purification methods.

One of the basic purification methods is crystallization from solutions, melts, and from vapor phases. The theory of crystallization processes, especially from solutions, is still not fully developed. Considering seeding, the problem of secondary core formation is of interest because it is the determining factor in recrystallization of highly soluble substances and very often it is also observed in recrystallization of sparingly soluble substances. The question over the structure of the crystal surface during crystal growth, which determines the mechanism of the process, is interesting. The quantitative characteristic of this structure is given by the so-called entropy factors.

It depends on many parameters which are yet to be studied, viz, the condition of the fluid layer above the crystal surface, volumetric defects in the crystals, the presence of impurities, solubility, and so on. During mass crystallization, the problem of achieving uniformity of crystal growth rate is very important because it underlies a number of of undesirable phenomena observed during the utilization and conservation of crystalline substances.

There is still a number of questions to be studied regarding the co-crystallization theory of various impurities. It is necessary to find ways to theoretically calculate the distribution coefficients of isomorphic and isodimorphous impurities and to find methods for rapid determination of these coefficients. The problems with nonisomorphic impurities are more complicated. Very often, these impurities are in a different state—in the liquid and solid state. The condition of nonisomorphic impurities in the liquid state is determined by the following processes: hydrolysis, macrocomponent ion complex formation, cluster formation at the expense of hydrogen bonds, formation of transition aggregates next to insoluble submicroscopic particles, and so on. The co-crystallization mechanism of these impurities depends on many factors: the rate of crystallization, the conditions of the crystal surface, their affinity for

adsorption on the growth areas on top of the growth steps and on top of the surface between steps according to chemical, geometric, or structural similarity.

A special case of nonisomorphic impurity inclusion is heterovalent isomorphic substitution in which, most often, an ion with a higher electric charge replaces an ion with a lower electric charge in a given crystal lattice. This is of interest not only in purification, but also in the activation of materials used in electronics. The basic condition for heterovalent substitution is electric charge compensation. This compensation can be achieved in various ways considering that, for the different planes of the same crystal, there may be different expedients for electric charge compensation, an important factor for the orientation of the substrate section during single-crystal growth. Thus, for example, bivalent impurity ions are included in the plane sectors (100) of the alkaline halide crystals with lattices of the NaCl type, after additional cation vacancies are created for electric charge compensation, while, in the (lll) plane, impurity ions are included by introducing halide ions in the counterpoise gaps of the crystal lattice. This has been proven by electronic paramagnetic measurements and by measuring the electroconductivity in various directions of the crystal.

Recently initiated experiments using modern equipment to observe in situ secondary seed formation, the structure of growing surfaces, hydrodynamic currents, etc. will help solve all types of problems concerning crystallization and co-crystallization of impurities. Similar experiments are those involving the determination of true crystal structure during the growth process by registering the acoustic emissions of the crystal at each deviation from proper growth, i.e., accumulation of dislocations, layer slippage, doublet formation, disorientation of blocks, formation of a new phase, and so on. In situ experiments will be expanded more and more in the future.

Experiments carried out under microgravity, started over the last few years, are of interest. These experiments will help answer some questions related to dislocations formed during single crystal growth which are observed even when all types of convection in the liquid phase have been completely eliminated.[4]

Regarding sorption methods, there is a great deal of unanswered questions related to purification by adsorption and collector coprecipitation. So far, there is only a qualitative explanation for some of the data. The situation with electrochemical purification is similar. The theory of distillation and rectification processes is comparatively well developed, but a great deal of work is still necessary to understand the equilibrium of the various components in the liquid and vapor phase.

The question of summarizing the accumulated knowledge on ultrapure materials is important. Very little has been written about this question. The only treatise on the methods of obtaining ultrapure substances written by an IREA team came out in 1969.[10] From then up to the present, no work of that nature has been published. Specialized journals in this field are few.

Scientific and applied work on obtaining ultrapure materials to be used in electronics must deal with the following difficulties: removal of microscopic solid particles and their identification, contact contamination from the walls of the vessels and equipment used, analytic control of ultrapure substances, optimization of the purification conditions and construction of special equipment for automating these processes.

Solving scientific and applied problems related to obtaining ultrapure materials to be used in electronics must be accomplished through sub-specialization because the processes following each stage of purification are becoming more and more complicated and specific. Specilization is necessary when training personnel for scientific research and industrial work. The production of ultrapure materials requires responsibility and the task must not be given to inexperienced personnel. Modern equipment is necessary both for scientific research and industrial work in order to delve more deeply into the very nature of purification processes and to ensure optimum conditions for production.

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BIOTECHNOLOGY

Nuclear Applications in Brazil's Biotechnology Research

Influence of Phenolic Components on Rumen Microbial Activity

36990028a Piracicaba ENERGIA NUCLEAR & AGRICULTURA in Portuguese
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[Text] Influence of Phenolic Components on Rumen Microorganism Activity*

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Summary

In view of the toxicity of phenolic acids for microorganisms, "in vitro" experiments were conducted to assess the effect of tannic acidcon centration on the activity of rumen flora. Samples of bovine rumen content were incubated in a medium containing bicarbonate, glucose, and different amounts of tannic acid (0, 0.1, 0.4, 0.8, and 1.2 g). One μCi of ^{32}P was added and, after 6 hours, the incorporated radioactivity was measured.

The growth of he microorganisms was affected by the addition of the compound, and a negative correlation was noted between the concentrationand the microbial activity.

Influence of Phenolic Compounds on Rumen Microbial Activity

Summary

In view of toxicity of phenolic acids on many microorganisms, an "in vitro" experiment was carried out to examine the effect of tannic acid on rumen microbial activity. Rumen content was incubated with sodium bicarbonate, glucose, and different quantities of tannic acid (0; 0.1; 0.4; 0.8; and 1.2 g). One μCi of ^{32}P-labeled phosphate was added and after 6 hours the incorporated radioactivity was measured.

Microorganism growth was affected by addition of tannic acid, and it was observed that there was a negative correlation between its concentration and microbial activity.

1. Introduction

Phenolic acids are common ingredients of fodder for ruminants, and some, such as ferulic and p-coumaric acid, can represent over 2.5 percent of the weight of the cellular walls of tropical grasses (Hartley and Jones, 1977; Kuwatsuka and Shindo, 1973).

These compounds are toxic to rumen bacteria and protozoans (Chesson et al, 1982; Akin, 1982); and "in vitro" studies indicate that certain fodders containing phenolic acids inhibit the digestibility of cellulose. Varel and Jung (1984) observed a 10-50 percent decrease in the digestibility of fodder cellulose due to the presence of those compounds; and an increase was noted after the removal of these acids with alkalis (Hartley and Jones, 1977). Jung and Fahey (1984) reported that the digestibility of alfalfa cellulose and protein increased following the removal of phenolic compounds.

Tannins are polyphenolic compounds which form complexes with vegetal proteins and digestive enzymes (Swain in Schultz et al, 1981), reducing digestibility and acting as anti-nutritional factors (Feeny, 1969; Pridham, 1963; Goldstein and Swain, 1965).

Some studies of the action of rumen microorganisms on phenolic acids have been made (Martin in Chesson et al, 1982), but the effects on the metabolism of ruminal flora were not reported.

The purpose of this work was to examine the effect of different concentrations of tannic acid on rumen flora activity.

2. Material and Methods

Samples of 32 ml of bovine rumen content were incubated, at 39 degrees C, in an anaerobic medium containing sodium bicarbonate solution (3 g/l), 0.2 of glucose, and 1 gmCi of 32P, such as Na2HPO4. Different concentrations (0, 0.1, 0.4, 0.8, and 1.2 g) of pure tannic acid were added to the incubation flasks.

After 6 hours, the fermentation was stopped with 5M sulfuric acid, and the microorganisms were separated by centrifugalization (15,000 rpm - 10 minutes).

The pellets were washed three times with saline (0.85 percent), and digested with perchloric acid. The radioactivity was measured on the supernatants and pellets for Cerenkov effect.

The amount of inorganic phosphorus in the rumen centrifuged content was determined, and the quantity of phosphorus incorporated was reckoned, based on the work of Van Nevel and Demeyer (1973).

The experiment was repeated 10 times, with two flasks per treatment. For the statistical analysis, 10 blocks were considered, with five treatments, in a factorial schema.

3. Results and Discussion

The average figures on incorporation of 32P are shown in Table 1.

The statistical analysis indicated that there was an effect from the treatments (1 percent), and the Tukey test revealed that:

- The amount of phosphorus incorporated was significantly greater for the control flasks to which no tannic acid was added;

- There were significant differences in the incorporation with respect to the control, when concentrations of 0.1 or 0.4 g of the compound were used. The results for those two treatments did not differ from one another.

- For concentrations of 0.8 and 1.2 g, the results were statistically significant with respect to the control and the 0.4 concentration, but they did not differ from one another.

Figure 1 illustrates the correlation between the incorporation of 32P and the tannic acid concentration. There was a high negative correlation (r = 0.89) between the figures, indicating that, as the amount of tannic acid increases, the incorporation decreases.

Considering the significance of the incorporation test originally proposed by Van Nevel and Demeyer (1973), as a cellular growth measurement, it may be claimed to have been affected by the addition oftannin.

These results agree with those cited by Jung and Fahey (1984), to the effect that the growth of aerobic or anaerobic bacteria is inhibited by phenolic compounds which cause damage to the cell tissue and lysis, with the release of their contents.

One important feature of ruminant nutrition associated with this effect lies in the fact that the phenolic radicals are part of the lignin structure, and can be released in the digestive process.

It is known that, during the physical treatment of fibrous residue used in animal feed, there is an increase in free phenolic radicals (Campbell et al, 1973; Vitti, 1984). This fact has also been observed in certain species of grass treated with NaOH (Hartley and Jones, 1977).

Moreover, the existence of certain fodder species containing naturally larger concentrations of tannins (Barry and Duncan, 1984) can prompt the ruminants to consume considerable quantities of phenols, which would entail adverse effects, such as a reduction in consumption and depression in the digestion of proteins.

4. Conclusions

This study indicated that the activity of the rumen flora was affected by the addition of tannic acid to the incubation medium, with a high negative correlation (r = 0.89) between the concentration of this compound and the growth of microorganisms.

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Table 1 - Incorporation of 32p (mg) by rumen microorganisms in a medium containing different concentrations of tannic acid.

Tannic acid concentrations (g)	Experiments										Averages
	1	2	3	4	5	6	7	8	9	10	
0	0.401	0.336	0.454	0.378	0.250	0.677	0.790	0.839	0.478	0.529	0.513a
0.1	0,234	0,226	0.278	0.218	0.240	0.422	0.544	0.599	0.347	0.311	0.342b
0.4	0.146	0.178	0.177	0.202	0.193	0.458	0.443	0.482	0.369	0.406	0.305bc
0.8	0.140	0.137	0.167	0.161	0.180	0.327	0.326	0.271	0.264	0.381	0.235cd
1.2	0.113	0.122	0.113	0.154	0.173	0.280	0.240	0.108	0.304	0.184d	

DMS = 0.0933.

a, b, c, d = averages with different letters are statistically different (P 0.05).

Gamma-Ray Sensitivity of Sorghum

36990028b Piracicaba ENERGIA NUCLEAR & AGRICULTURA in Portuguese
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[Text] Sensitivity of Simple Strains and Hybrids of Sorghum (Sorghum bicolor) to Gamma-Rays

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Summary

In work on mutation induction, a determination of sensitivity to the mutagenic to be used is an essential preliminary step. In a project directed by the National Center for Research on Corn and Sorghum, with the cooperation of CENA [Center for Use of Nuclear Energy in Agriculture], it was found that the BR 005 strain showed behavior quite different from that of other sorghum materials during the irradiation of seed with gamma-rays. Therefore, it was decided to carry out more detailed work, including this strain. A comparison was made of the sensitivity to gamma-rays of four strains, BR 007-A, BR 005, BR 501, and BR 008-A, and two simple hybrids of sorghum, BR 007-A x BR 005 and BR 501 x BR 008-A. This was accomplished through two experiments, analyzing the reduction in the height of the seedlings in comparison with the non-irradiated controls. In the first experiment, the seeds of the six materials were irradiated with 10, 15, and 20 krad, in CENA's 60Co source. It was noted that the only material to show a significantdecline in seedling height was the BR 005 strain, starting at 10 krad. In the second experiment, which included only the BR 005 and BR 007-A strains and the hybrid between them, the doses were 20, 23, and 26 krad. Again, the BR 005 strain was the most sensitive; whereas, for BR-007-A, there was no significant decrease in the seedling height for any of the doses used. In the case of the hybrid between these strains, no decline was observed with respect to the control for the 20 and 23 krad doses; but a decline was noted for 26 krad. Some of the causes that might explain the BR 005 strain's greater radio-sensitivity are discussed. Based on the reaction of the hybrid and the parental strains, some comments are also made regarding the genetic basis for the radiosensitivity.

Gamma-Ray Sensitivity of Inbred Lines and Single-Cross Hybrids of Sorghum (Sorghum bicolor)

Summary

In mutation induction experiments, determination of sensitivity to mutagens that will be used is a preliminary and indispensable step. In the experiment conducted by CNPMS [National Center for Research on Corn and Sorghum]/EMBRAPA [Brazilian Agriculture and Livestock Research Enterprise], in collaboration with CENA [Center for Use of Nuclear Energy in Agriculture]/USP [Sao Paulo University], it was verified that the inbred lines BR 005 showed a very different reaction when the seeds were gamma-irradiated. For this reason, one more detailed work, including four lines, that is, BR 005, BR 501, BR 007-A, and BR 008-A, and two single cross hybrids, BR 007-A x BR 005 and BR 501 x BR 008-A, was conducted. The work was divided in two experiments, and seedling height reduction to the control without irradiation was analyzed. In the first experiment, the seeds of the materials were irradiated with 10, 15, and 20 krad of gamma-rays from the 60Co source of CENA. It was observed that BR 005 was the only one material that reduced considerably its seedling height even with 10 krad. In the second experiment that included only BR 005, BR 007-A, and their hybrid, the doses were 20, 23, and 26 krad. Again, BR 005 showed to be most sensitive while BR 007-A did not show any significant reduction of seedling height in all doses. It was noted that the hybrid did not show any reduction in the doses of20 and 23 krad. The reduction was observed only in the treatment with 26 krad. Discussion was made

on possible causes that could explain the highest radio-sensitivity of BR 005. Based on the reaction of the hybrid and parental lines, possible genetic base of radio-sensitivity was discussed.

l. Introduction

Mutation induction is a tool that could prove quite useful in helping to solve certain problems involved in plant improvement. In these instances, both for the use of chemical and physical mutagens, the selection of the concentrations or doses to be used is extremely important. For example, for physical mutagens, when the seeds are treated there are several factors responsible for sensitivity to the radiation, as well as for the changes that could occur in certain treatments ((Gusman et al, 1975; Conger et al, 1977). For instance, environmental factors such as moisture content and temperature at the time of irradiation, or a physiological factor, such as age of the seed, or biological factors,such as genetic and varietal differences, could be responsible for the major variations observed in sensitivity. Such factors must be well understood and controlled (when possible), because the most correct choice of the dose to be used in mutation induction work, and hence even the success or failure of the research, could depend on them.

In the case of gamma-rays, there are lists such as that of Conger et al (1977) on which one observes the dose causing 50 percent reduction in growth of a series of cultures, as well as the doses most used for mutation induction. Although this and other lists serve as a reference point, the differences in radio-sensitivity among genotypes within one species can be great. For example, in beans, Tulmann Neto and Ando (1971), analyzing only eight cultures planted in Brazil, found differences of up to twice the amount of sensitivity to gamma-rays, comparing the LD50 among the cultures. Owing to these differences, the determination of the individual sensitivity to the material, with the mutagenic to be used, has become a common practice in work with mutation induction for plant improvement. Sometimes, because of the urgency of the occasion, this is not done, and the treatment is based on information from the literature or previous experience with other genotypes. In this case, one runs the risk of wasting all the planting work on the seeds treated.

In view of what has been noted, and as a result of the research conducted by the National Center for Research on Corn and Sorghum (CNPMS), in cooperation with CENA, it was decided to carry out this work. The purpose was to study the radio-sensitivity to gamma radiation among four strains of sorghum and two of its simple hybrids.

2. Materials and Methods

Seeds of the parental strains BR 007-A and BR 005, and of their simple hybrid, BR 300, and of the parental strains BR 501 and BR 008-A, and of their simple hybrid, BR 602, provided by CNPMS, were used. The percentage of moisture in these materials was determined by placing samples of the seeds in an incubator until a constant weight was reached.

The seeds were irradiated at CENA with gamma-rays originating in the Gammabeam 650 irradiator. Two experiments were performed, and in both, the seeds were placed in the center of the irradiator at 23 cmfrom the exposure tubes. using a dose rate of 378.3 krad/hour. In the first experiment, samples of 100 seeds of the four strains were irradiated with 10, 15, and 20 krad; and these materials, plus the non-irradiated controls, were sown in boxes with soil, and kept in a vegetation chamber, using the demarcation of subdivided plots, with three repetitions (doses as plots, and materials as subplots). The sensitivity measurement was made, noting the height of the seedlings 15 days after their emergence.

In the second experiment, samples of 50 seeds of the strains BR 007-A and BR 005, and of their hybrid, BR 300, were irradiated with 20, 23, and 26 krad, in the same manner described previously, using for the seeding the demarcation into blocks, at random, with four repetitions. The sensitivity was measured as before.

3. Results and Discussion

As we observed previously, the moisture content of the seeds is one of the factors that can affect radio-sensitivity; which is why it was decided to determine its amount before the experiment. The results demonstrated that all the materials showed a moisture content of 10.5 percent, with the exception of the BR 501 strain (10.0 percent). Hence, it may be claimed that the percentage of moisture was virtually the same for all the materials, and could not be held responsible for a potential difference in radio-sensitivity among them.

The results of the analysis of variance in the first experiment are given in Table 1. One notes that the F figure was significant, both for dose and materials, and for interaction. Hence, the latter factindicates that the materials behaved differently in relation to thedoses; and so there were differences in radio-sensitivity among them.The significant figure for the materials was already anticipated, inasmuch as there are strains and simple hybrids, and a greater height is expected for them. Also to be expected are differences among doses, because the reduction in seedling height with an increase in dose is typical in this type of work.

To compare averages, based on the purpose of this work, it was considered that, if the averages of the different doses for one and the same material were compared, using the Tukey test, with the average of the control of the same material, the combination of these comparisons would serve to demonstrate the existence of a difference in radio-sensitivity among the materials. That is, it was attempted, for example, to compare the average seedling heights of BR 005 resulting from treatment with

10, 15, and 20 krad, with the average for the non-irradiated BR 005. The same thing was done for the other five treatments. The comparisons among the average seedling heights for the different doses and materials, measured after 15 days, as well as those averages in relation to the controls, considered as 100, are shown in Table 2. One may conclude that, with the exception of the BR 005 strain, the doses of 10, 15, and 20 krad did not affect the growth of the materials. In this respect, the experiment would not be useful forindicating doses to be used in actual mutation induction work. This is because in such instances, the purpose is to select doses causing a 30 to 50 percent reduction in the height of seedlings from theM1 generation. However, for the BR 005 strain, starting at 15 krad, a reduction was noted in the average seedling height. In fact, this strain was observed to be very sensitive to radiation; and the dosecausing a 50 percent reduction in seedling growth may be estimated at between 15 and 20 krad. This figure could not be estimated for the other materials, but it exceeds 20 krad.

The results accrued serve to illustrate what was discussed at the beginning of this report. In fact, according to the list of Conger et al (1977), the dose causing a 50 percent reduction in sorghum growth lies between 15 and 20 krad for the BR 005 strain. Therefore, the need for making preliminary tests every time it is decided to use treatments with mutagens has been proven once again.

Based on the experiment described, it was decided to conduct a second one, including the BR 005 and BR 007-A strains, and their simple hybrid, BR 602, increasing the radiation doses.

The results from the analysis of the variance in seedling height after 15 days are found in Table 3, where one notes the significant F figure for treatments. In Table 4, as in the previous instance, comparisons are made, using the Tukey test, of the averages of the different treatments in one and the same material, with the average of the control. One notes that, just as in the previous case, for the lower dose (20 krad), the BR 005 strain showed a large height reduction compared with the control; whereas the BR 007-A strain had no significant decrease in height with the increase in dose. In the case of the hybrid between these strains, it was found that the doses of 20 and 23 krad did not result in a reduction in height, compared with the control. This occurred only for the highest dose (26 krad); although this figure was not significantly lower than that for the 23 and 26 krad doses.

The results shown from these two experiments attest to the presence of differences in radio-sensitivity in sorghum materials, the BR 005 strain being very sensitive to gamma-rays insofar as reduction in seedling height is concerned. These differences were reported for the majority of species studied, such as peas (Blixt, 1972), corn (Conger, 1976), and rice (Fuji, 1962), and also in sorghum, in work by Iqbal (1980), Belo and Ayala Osuna (1980), and Reddy and Smith (1983). In some of these reports, the authors noted that a given material could be considered more or less sensitive to radiation depending on the characteristic studied for determining the radio-sensitivity. For example, in sorghum, Iqbal (1980) observed that one culture was more sensitive with respect to a reduction in seedling height, whereas the other was more sensitive from the standpoint of a reduction in the number of seeds. Since only one criterion (seedling height) was usedin this work, that fact should be underscored.

While it is easy to note varietal differences in radio-sensitivity, it is not so easy to spot the reasons for such differences, or their genetic control. It is known that, in the case of different species, the radio-sensitivity is inversely correlated with the nuclear volume and interphase chromosomic volume (Sparrow, 1965). But in the case of genotypes or cultures within one and the same species, this relationship is not always maintained (Conger, 1976; Mukherjee and Basu, 1975).

Conger (1976) remarks that, in such instances, potential mechanisms forincreasing radio-sensitivity include the absence or low concentration of catalase or peroxidase, enzymes known to have the capacity to cause decomposition of radiation products. Or else the greater radio-sensitivity might be due to a lack or low concentration of enzymes compensating from the effects of the radiation.

In sorghum, Reddy and Smith (1983) attribute the differences in radio-sensitivity to specific genetic differences and, possibly, to cytoplasmatic differences.

Several reports have been made regarding the genetic basis for sensitivity to radiation, in which the authorities analyzed the F1 or F2 obtained by crossbreeding materials with different radio-sensitivities. In peas, Blixt (1972) concluded that no gene specifically controlling sensitivity to gamma-rays was established; though he admits that certain genes controlling given characteristics wield an influence on sensitivity. This author also concluded that an increase in the number of recessive genes makes a variety more sensitive.

In soybeans, Takagi (1974), studying crossbreeds among varieties resistant or sensitive to gamma-rays, concluded that, in most instances, the radio-sensitivity is controlled by a single pair of genes, greater resistance being dominant.

Conger (1976), studying strains and their hybrids in corn, found evidence that the greater sensitivity would probably be controlled by one or more recessive genes. But he notes that other authors had reported cases of a polygenic system involved. Emery et al (1970), studying varieties and hybrids of peanuts, concluded that the F1 showed greater resistance to X-rays than did the parentals. However, he did not think that this fact could be explained by a mere dominance; admitting that there is evidence that the genetic dominance reaction is often involved in the inheritance of radio-sensitivity.

In this work, only the F1 generation was studied, involving crossbreeding between a sensitive strain (BR 005) and another which was resistant (BR 007-A) to the doses of gamma-rays used. Observing the results of the two experiments (Tables 2 and 4), one notes that, for all the doses used (10, 15, 20, 23, and 26 krad), the BR 007-A strain showed no significant growth reduction, compared with the control; the BR 005 strain showed such a reduction starting with 10 krad; while the Fl between them showed a height reduction in comparison with the control only with the highest dose (26 krad). As has been observed in the previous discussion, these results suggest that a possible genetic dominance reaction may be involved, with the reaction of greater sensitivity in the BR 005 strain due to one or more recessive genes. It is interesting to note that, whatever the mechanism involved in the hybrid's greater resistance, compared with that of the BR 005 strain, may be, it operates only up to a certain level of radiation (23 krad, Table 4). In fact, for 26 krad, the decline in the height of the seedling in comparison with the control was significant, and the same thing happened for the BR 005 strain; whereas the BR 007-A strain showed no significant reduction. As was noted previously (Conger, 1976), it is possible that enzymes compensating for the effects of the radiation, in high radiation doses, may not have sufficient concentration to act.

4. Conclusions

Studies based on the reduction in seedling height, involving four strains and two hybrids of sorghum, demonstrated that one strain (BR 005) was highly sensitive to the doses of gamma-rays used. The reaction of greater resistance to radiation of the F1 involving this strain and a resistant one (BR 007-A) indicated that a genetic dominance reaction could be implicated. In this case, the BR 005 strain would show arecessive gene or genes for greater sensitivity; however, other experiments, including the F2, are necessary to confirm this indication. The mechanism giving greater resistance to the BR 007-A strain would operate even for the highest dose used (26 krad), while, for the hybrid between BR 007-A and BR 005, in this dose an increase is observedin comparison with the control.

Although no conclusions can be reached regarding the reasons for the BR 005 strain's greater sensitivity, there is, once again, evidence of the need for carrying out preliminary work to select the dose every time anactual project aimed at inducing mutation is started.

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Footnotes:

1. Radiogenetics Section, CENA/USP; CNPq [National Council for Scientific and Technological Development] Fellow.

2. EMBRAPA National Center for Research on Corn and Sorghum, Sete Lagoas, Minas Gerais, "in memoriam," to whom this work is dedicated.

3. Radiogenetics Section, CENA/USP, and Genetics Department, ESALQ/USP; CNPq Fellow.

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Table 1. Analysis of the variance in seedling height of sorghum strains and hybrids originating in irradiation of seeds with different doses of gamma-rays. Experiment in sub-divided plots with three repetitions.

Source of variation	G.L.	S.Q.	Q.M.	F
Blocks	2	38.5257	19.2629	
Doses (D)	3	108.8987	36.2996	9.93**
Residue (a)	6	21.9265	3.6544	
(Plots)	(11)	(169.3509)		
Materials (M)	5	579.5281	135.9056	167.29**
Interaction (DXM)	15	166.2484	11.0832	13.64**
Subplots	41	1,047.6248		

C.V. plot = 12.00

C.V. subplots = 6.00

Table 2. Comparisons between the average height * of seedlings of strains and simple hybrids of sorghum, originating in different doses of gamma-rays, using the Tukey test; ** the average of each treatment was compared with that of its non-irradiated control.

Doses (krad)	Strains BR 007-A	BR 005	Simple hybrids: BR 300 (BR 007-A x BR 005)	Strains BR 008-A	BR 500	Simple hybrids: BR 602 (BR 008-A x BR 500)
0	12.6a	17.3a	18.8a	17.6a	16.0a	22.2a
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
10	13.0a	14.4b	17.3a	17.5a	15.6a	21.2a
	(103.0)	(83.2)	(92.0)	(99.4)	(97.5)	(95.5)
15	13.3a	12.1b	17.9a	17.4a	15.6a	20.9a
	(105.6)	(69.9)	(95.2)	(98.9)	(97.5)	(94.1)
20	11.8a	5.0c	17.3a	15.8a	14.3a	20.2a
	(93.7)	(28.9)	(92.0)	(89.8)	(89.4)	(91.0)

* Numbers outside parentheses indicate seedling height in cm. Numbers inside parentheses indicate height in comparison with non-irradiated controls, considered as 100.0.

** Numbers followed by the same letter indicate lack of significant statistical difference on the 5% probability level.

Table 3. Analysis of the variance in height of seedlings of strains and simple hybrids of sorghum originating in irradition of seeds with different doses of gamma-rays. Experiment in blocks, at random, with four repetitions.

Sources of Variation	G.L.	S.Q.	Q.M.	F
Blocks	3	26.2792	8.7597	2.32
Treatments	11	1707.5702	55.2337	41.21 **
Residue	33	124.2958	3.7665	
	47	1858.1452		

C.V. = 18.4%

Table 4. Comparisons between the height* averages of seedlings of strains and simple hybrids of sorghum, originating in different doses of gamma-rays, using the Tukey** test. The average of each treatment was compared with that of its non-irradiated control.

Doses (krad)	Strains BR 007-A	BR 005	Simple hybrid: BR 300 (BR 00-A x BR 005)
0	11.0a	16.6a	18.7a
	(100.0)	(100.0)	(100.0)
20	8.9a	2.4b	17.1,a,b
	(80.9)	(14.5)	(91.4)
23	9.3a	1.7b	16.2a,b
	(84.5)	(10.2)	(86.6)
26	9.2a	1.3b	13.1b
	(83.6)	(7.8)	(70.1)

* Numbers outside parentheses indicate height in cm, measured 15 days after emergence. Number inside parentheses indicates height in comparison with the non-irradiated controls, considered as 100.0.

** Numbers followed by the same letter indicate lack of significant statistical difference on the 5% probability level.

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SCIENCE & TECHNOLOGY POLICY

New Loans From Brazil's BNDES to Aid Electronics Industry

36990040 Sao Paulo GAZETA MERCANTIL in English 21 Dec 87 p 7

[Text] BNDES, the national development bank, has approved two loans totaling Cz$1.31 billion ($19.7 million) for development of new projects in the electronics industry.

The loans for the two electronics companies, unlike recent help for the troubled Sharp group (report in last week's issue), are purely for technological development and do not reflect deep financial problems.

Some Cz$978 million ($14.9 million) of the loan will go to computer maker Labo Electronica S.A. for local production of West Germany's Nixdorf 8890 supermi-nicomputer and marketing of the supermini 8090.

Labo, based in metropolitan Sao Paulo, will need the funds to produce only a small portion of the Nixdorf 8890 because the company already manufactures virtually all parts for the computer, according to vice-president of Labo, Marco Filippi.

The loan will be amortized over 6 years at 6 percent interest per year plus monetary correction, with a 2-year grace period.

The second loan, for Cz$329 million ($5 million), is to PHT Sistemas Electronicos, based in Campinas just north of Sao Paulo. This loan is part of a $14 million package from BNDES whose first tranche was disbursed in December 1986. The loan will be used to invest in the production of Tropico-type telephone public digital switching units.

Production is running at six Tropico units per month with orders over the next 25 months valued at 40 million. Sales this year are estimated at $3 million, almost triple the amount sold last year.

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