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FIRST ALL-UNION CONFERENCE OF HIGHER EDUCATIONAL INSTITUTIONS ON RADIOCHEMISTRY OF THE USSR

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From 20 to 25 April 1959 there took place in Moscow the First Conference of the Higher Educational Institutions of the USSR on Radiochemistry, which convened on the occasion of the annual Lomonosov lectures at Moscow State University commemorating the 50th anniversary of the brilliant work of V. I. Lenin on "Materialism and Empirical Criticism." Eighty-three reports, which represented 17 higher institutions of learning, were taken into consideration at the Conference. About 400 persons from 32 higher educational institutions of the Soviet Union participated in the activities of the Conference.

The reports embraced a wide range of problems: methods of separation and concentration of radioactive isotopes; chemistry of natural radioactive elements; chemistry of "hot" atoms; synthesis of labeled compounds; state of microcomponents of radioactive elements in solution and in the solid phase; co-precipitation of radioactive elements; mechanism of reaction and isotope exchange; application of isotopes as indicators in thermodynamics of metals, alloys, oxides, and salts in analytic, inorganic, organic, and other problems in chemistry; methods of teaching; instruments and measuring techniques; planning of radiochemical laboratories.

The conference was opened by introductory remarks made by representative of the organization's committee, An. N. Mesmeyanov, who briefly characterized the profound development of science of the XXth century, leading humanity toward the discovery of the innermost secrets of nature, the detection of neclear transformation, hyman control of the forces existing within the nucleus of the atom. As a result of efforts of scientists of various countries, new areas in science and in radiochemistry, in particular, have been explored. Furthermore, the chairman indicated that Soviet radiochemistry was at the head of the list in this division of chemistry and especially of the USSR's broad development of applied radiochemistry.

The higher institutions of learning of the USSR also train

staffs of radiochemists for our country and conduct extensive investigative work in the sphere of radiochemistry and especially in the field of application of radioactive isotopes for scientific investigations.

The First All-Union Conference has set the following goals: to summarize the works on radiochemistry in the higher institutions of learning of the country, to encourage them still more, to raise the quality of instruction in radiochemistry, and to improve the technique of work with radioactive isotopes.

The report of N. P. Rudenko and A. I. Sevast'yanov (Moscow State University) dealt with the recovery of beryllium-7 by means of a secondary nuclear reaction which occurs with bombardment of lith lithium targets by neutrons. The authors discussed means of utilizing this reaction in obtaining indicative amounts of beryllium-7. V. B. Shevchenko and I. A. Fedorov (Moscow Institute of Chemical Technology imeni D. I. Mendeleyev) studied the influence of temperature on the extraction of nitrates of uranyl, plutonium, ruthenium, and zirconium by tributylphosphate. It was found that the temperature regime at various stages of the process of nuclear fuel extraction by tributylphosphate will significantly improve the purification of uranium and plutonium from fission products. An original method of concentration of radioactive cesium using gelatin foam formation was developed by V. V. Pushkarev, L. D. Skrylev, and V. F. Bagretsov (Ural Polytechnical Institute). B. Z. Iofa (Moscow State University) proposed a new method of separating isotopes without carriers, based on the phenomenon of internal electrolysis. The possible separation without carriers of a large number of radioactive isotopes by extraction in the form of beta-diketonates was presented in the paper of I. Stara and N. P. Rudenko (Moscow State University).

The papers of B.'K. Preobrazhenskiy and coworkers (Leningrad State University) were devoted to the ion-exchange separation of elements of groups III, IV, and V. The methods developed permitted the separation of radioactive isotopes with and without carriers. V. P. Meleshko, V. B. Voytovich (Voronezh State University) suggested a method of some radioactive preparations. Interesting experimental material on the sorption of phosphate ions with an anode film on aluminum in relation to various factors was obtained in the investigations of A. F. Bogoyavlenskiy, V. T. Belov, and Ye. M. Kozyrev (Kazan Aviation Institute). The authors explained the mechanism of the sorption process in the system studied. The paper of D. N. Strazhesko, G. F. Yanovskiy, and L. P. Boykov (Kiev Medical Institute) was devoted to an investigation of the sorption of cations with silica gel and quartz with the application of radioactive tracers. On the basis of the studies of the sorption of cations (sodium, cesium, calcium, strontium, and silver) on ordinary methoxylated silica gel and on quartz as well, the heterodynamics of the cation-exchange groups on the surface of the silica gel was established. V. I.

Paramonova, A. N. Mosevich, and N. V. Goryanin (Leningrad State University) developed a method which permits quantitative adsorption of thorium-234 on platinized carbon. The paper of V. V. Pushkarev, Yu. V. Yegorov, Ye. V. Tkachenko, and V. D. Puzako (Ural Polytechnical Institute) established the possibility of sorption of stronium-90 on iron hydroxide in the presence of alkaline earth metals. O. Ye. Zvyagintsev and O. I. Zakharov-Nartsissov (Moscow Institute of Chemical Technology imeni Mendeleyev) reported that by using isoamyl alcohol it was possible to extract gold from industrial cyanide solutions. A. F. Bogoyavlensky (Kazan Aviation Institute) presented the methods developed by him for the preparation of radioactive tracers on the basis of anode films of Al_2O_3 by means of direct anodizing and also charging the film. Such tracers could have extensive practical utilization.

Several reports applied to the study of the behavior and chemistry of natural radioactive elements. The investigation of emanation and extraction of radium isotopes from monazite was the subject of the report of K. B. Zaborenko, A. M. Babeshkin and I. V. Kovalenko (Moscow State University), who demonstrated the essential role of the surface and of recoil atom in the processes of emanation and extraction. Testing neutron radiation of natural minerals, V. V. Cherdyntsev, L. I. Shmonin, L. L. Kashkarov, V. F. Ostapenko, and O. D. Khaldeyev (Kazakh State University) concluded that the reaction $^{18}O(\alpha,n)^{21}Ne$ was the primary reason for neutron radiation of the earth. Ye. A. Isabayev, U. Kh. Asylbayev, and V. V. Cherdyntsev (Kazakh State University) presented a paper in which data was cited on two independent methods developed by them for the determination of actinium by means of its disintegration products. Both methods had the same sensitivity and allowed actinium to be determined accurately. The investigation of Ye. A. Isabeyev established the phenomenon of uranium isotope separation in uranium-containing minerals as a result of the effect of recoil, which produces the great mobility of uranium-234. In a comprehensive investigation completed by Ye. A. Ippolitova, Yu. P. Simanov, L. M. Kovba, G. P. Polunina, I. A. Bereznikova (Moscow State University) in the area of the chemistry of some uranates, it was shown how they successfully studied the composition of certain uranates of elements of the second group of the periodic system by methods of thermography and x-ray phase analysis. On the basis of crystalline chemical investigations of uranates L. M. Kovba (Moscow State University) determined three types of causes of uranyl oxide. V. G. Knyaginina and O. G. Nemkova (Moscow State University) reported on interesting new data which they had recovered in a study of uranium compounds of the lower valences. In a carefully executed investigation on extraction and solubility of uranyl salts in simple esters, V. M. Vdovenko, D. N. Suglobov and I. G. Suglobova (Leningrad State University) on the basis of isothermic solubility in the triple system showed that in the coordination sphere

of uranium there entered two nitrate groups and two molecules of water (orgnaic solutions).

Questions on the chemistry of "hot" atoms were considered in reports of V. D. Nefedov and coworkers (Leningrad State University). In the report "Chemical Changes Induced by the Processes of Beta-Decay" one showed the current status of the question about chemical changes induced by the processes of beta-decay. In the work, executed jointly with Yu. A. Grachev, the author discussed the application of the method ofpaper chromatography for the separation of different forms of radium-E. Manifestation of the isotope effect in the processes of beta-decay were observed by V. D. Nefedov, Yu. A. Ryukhin, and M. A. Toropov (Leningrad State University) in the distribution of bismuth among several chemical forms of ntaural isotopes, which, in the opinion of the authors of the work, can explain the difference in the patterns of disintegration of the parent isotope. Analyzing the chemical transformations occurring with beta-disintegration of radium-D, which entered into the composition of some radically deficient phenyl-derivatives, V. D. Nefedov, V. A. Bykhovtsev, Wu Chi-lan, S. A. Grachev (Leningrad State University) established that every act of disintegration of the parent molecule took place independently and was not involved in the resulting changes of the neiboring molecules of parent substances. The presence of the isotope effect in the bombardment of methyl bromides by neutrons was observed in investigations accomplished by An. N. Nesmeyanov. Ye. A. Borisov, E. S. Filatov, V. N. Kondratenko, Chang Tse-hsinag, B. Shukla, and K. Panek (Moscow State University). The report of B. G. Dzantiyev, N. M. Barkalov, and V. V. Khrapov (Moscow State University) stated the results of investigations on the reaction characteristics of "hot" radioactive atoms of sulfur-35 and nitrogen-13, recovered through various nuclear reactions. Conversion, separation, destruction, and condensation reactions were studied. The report of K. B. Zaborenko, A. M. Babeshkin, and M. S. Aul'chenko (Moscow State University) told of a study of the mechanism of accumulation and separation of recoil atoms using the example of isotopes of radium (radium-224 and radium-228) in the system solid phase - gas and solid phase - solution. V. I. Spitsyn (Moscow State University) presented a report on the influence of the radioactive of solid bodies on the heterogenous processes occurring with their participation. The speaker cited examples of the influence of higher specific activity on such processes as isotope exchange, catalysis, and adsorption.

A large number of reports were devoted to isotope exchange and study of the mechanism of the reaction. I. Ye. Mikhaylenko and V. I. Spitsyn (Moscow State University) studied isotope exchange at a high temperature in the system of potassium sulfate-sulfur anhydride. Yu. Ya. Filalkov (Kiev Polytechnical Institute) rendered a report on the conditions of exchange in aqueous solutions

between compounds of halogens with different degrees of oxidation. Reviewing the cited facts, the speaker expressed an opinion about the mechanism of exchange. A study of isotope exchange in the system $Bi(C_6H_5)_3$ - $Bi(C_6H_5)_3Cl_2$ - alcohol was accomplished by V. D. Nefedov, Ye. N. Sinotov, and V. D. Trenin. It was shown hereby that exchange was related to the transfer of electrons. A radiochemical investigation of the exchange of radicals in some metallic organic compounds was presented by I. A. Korshunov, A. P. Batalov, and A. A. Orlova (Gorkiy State University). A similar investigation on the exchange of phenyl radicals in systems which contain mercury and manganese was studied by Ye. N. Sinotov, M. Vobetskiy, L. N. Yevtikheyev, Yu. N. Loginov (Leningrad State University). The paper by O. K. Skarre, V. F. Grechanovskiy (Dnepropetrovsk State University) described an investigation of the mobility of the sulfur group in various aromatic compounds using a radio-isotope of sulfur by the method of exchange. The report of V. L. Antonovskiy, I. V. Berezin, and N. F. Kazanskaya (Moscow State University) referred to the application of tritium for the determination of relative constants of the rate of break away of hydrogen atoms in organic compounds. V. M. Fedoseyev (Moscow State University) reported for a group of investigators on the application of paper radiochromatography for the study of the mechanism of the interrelationship of thiourea with some organic bromides.

The report of K. B. Zaborenko. A. M. Babeshkin, V. A. Berevskiy, and L. L. Melekhov (Moscow State University) discussed the possibility of studying conversions in solid bodies with heating by the emission method, using barium titanate as an example. Very similar investigations were also accomplished using barium phosphorotungstate by V. I. Spitsyn, K. B. Zaborenko, A. M. Babeshkin, and M. A. Rodicheva (Moscow State University).

Numerous papers were concerned with the study of the status of microcompounds. V. D. Nefedov, Wu Chi-lan (Leningrad State University) studied the influence of compound structure and the conditions of disintegration of parent substances on the dissemination of an isotope of bismuth among different chemical forms. An. N. Nesmeyanov, B. M. Korolov, and L. A. Sazonov (Moscow State University) studied the process of isolating manganese-56 with radiation of a colloid dioxide of manganese. I. A. Korshunov and A. I. Shafiyev (Gorskiy State University) showed the influence of trifling additions of alcohols to the chemical state of radiophosphorus with irradiation of carbon tetrachloride. Studying the behaviro of bismuth-210 and lanthanum-140 without a carrier in aqueous dioxane mixtures, B. Z. Iofa, L. V. Bobrov, and A. P. Patov (Moscow State University) established the presence of colloid forms in a broad rance of pH solutions. In the work of I. P. Alimarin, T. A. Belyav, and Mu-Bin-Ven' (Moscow State University) it was shown that zirconium could be found in various forms, depending on the

acidity of the solution, both in the form of charged particles and neutral complexes. Using curves of relative absorption, V. I. Paramonova, A. S. Koreychuk, and B. A. Shishlyakova (Leningrad State University) studied the process of the complex formation of yttrium-91 with acetic and lactic acids. A. V. Lapitskiy, Chuang Ya-Wei, and I. A. Savich (Moscow State University) presented new data on the processes of precipitation of protactinium with complex compounds of titanium, niobium, and tantalum. The report of V. P. Shvedov, S. G. Strizhov, and Ch'ing Tse-hou (Leningrad Technological Institute) demonstrated the possibility of utilization of binary potassium selenate and lanthanum for co-precipitation of cerium (IV) and plutonium (IV). M. S. Merkulov and I. V. Melekhov (Moscow State University) presented general principles, confirmed experimentally, of co-precipitation of radioelements with crystalline sediments. In the report of L. L. Makarov, G. S. Popov, A. N. Popkov, D. Yu. Stupin, and Yu. G. Vlasov (Leningrad State University) the thermodynamic approach was shown, using as an example the system CsCl-RbCl-H_2O, and the empirical ration was found which connected the composition of saturated stable solutions with the coefficient of activity of the components. B. G. Lur'ye and A. N. Murin (Leningrad State University), using radioactive indicators, determined the heat of transfer of the complex (Cd^{2}+Ag+) in mixed crystals of AgBr + $CdBr_2$). Applying the electro-migration method, V. P. Shvedov and A. V. Stepanov (Leningrad Technological Institute) determined the constants of instability of complex compounds existing in an extreme stage of dilution. The authors revealed an equation for the calculation of the instability constant. Co-precipitation of microgram amounts of iron, cobalt, copper, silver, and gold with calcium phosphate was the subject of the reports of Yu. V. Morachevskiy, V. N. Zaytsev, A. P. Taranov, and Chang Huo (Leningrad State University). The authors established the possibility of franctional precipitation of the studied elements. An analogous investigation was presented by A. I. Novikov (Tadzhik State University), who studied the co-precipitation of some anions with hydroxy metals. Kh. Ya. Kuus (Tartu State University), using radioactive indicators, determined the optimal conditions for co-precipitation of germanium and hydroxy iron. In the report of I. M. Korenman (Gorskiy State University) it was shown that if radioactivity was applied in the "component-property" system for the tested property, then the method of radioactive indicators could also find application in physical-chemical analysis. Ya. D. Zel'venskiy (Moscow Institute of Chemical Technology imeni Mendeleyev), using labeled atoms, conducted experimental investigations in the area of rectification. The authors established excellent correlation of experimental data with theoretical calculations.

Delegates to the Conference displayed marked interest in papers dealing with the synthesis of labeled compounds. A. P. Musakin (Leningrad Technological Institute) reported on methods of synthesis

of a large number of compounds containing radioactive isotopes of phosphorus, sulfur, carbon, etc. V. D. Nefedov and G. A. Skorobogatov (Leningrad State University) in a report on multi-labeled compounds discussed the nomenclature of labeled compounds. The authors suggested a rating form permitting a calculation of the liberation of different isotope isomers. Ya. D. Zel'venskiy and V. A. Shalygin (Moscow Institute of Chemical Technology imeni Mendeleyev) proposed a method for the recovery of labeled compounds containing sulfur-35. I. A. Korshunov and coworkers (Gorskiy State University) developed methods of obtaining aliphatic and aromatic hydrocarbons, aldehydes, ketones, and oxides of ethylene. In the same laboratory a radiochemical method was developed for the investigation of the Friedel-Crafts-Balson reaction.

A series of reports was devoted to the application of radioisotopes in the study of metals and alloys. An. N. Nesmeyanov and De Dyk-Man (Moscow State University) measured the vapor pressure of solid cobalt and its partial pressure in alloys with nickel. The report of Yu. A. Priselkov, Yu. A. Sapozhnikov, A. V. Tseplyayeva, and V. V. Karelin (Moscow State University) considered possible reasons for errors in the determination of vapor tension with high-frequency heating. The authors accurately determined the vapor tension of indium and thallium. In a study of volatility of niobium oxides, accomplished by I. V. Golubtsov, A. V. Lapitskiy, and V. K. Shiryayev (Moscow State University) it was shown that niobium pentoxide was subject to thermal dissociation in a vacuum under high temperatures; the vapor pressure of noobium dioxide occurring with this was measured at wide ranges of temperature. D. K. Belashchenko (Moscow Institute of Steel) studied the phenomenon of electro-transformation of bismuth-lead into thin alloys. A. D. Sotskov, Kao I-Shan, and A. A. Zhukhovitskiy (Moscow Institute of Steel) reported on the application of radioactive isotopes for a study of diffusion processes accompanied by phase and chemical conversions. A study of the mobility, intermediate relationship, and dispersion of elements in zirconium was the subject of the report of G. B. Fedorov, Yu. F. Babikov, P. L. Gruzin, F. I. Zhomov, and G. G. Ryabov (Moscow Physical Engineering Institute). A method of radioactive indicators was successfully applied in an investigation on the formation of an electrolytic alloy of cobalt-titanium and was accomplished by S. M. Kochergin and G. R. Pobedimskiy (Kazan Chemical Technological Institute). O. E. Zvyagintsev and V. I. Shamayev (Moscow Institute of Chemical Technology imeni Mendeleyev) developed a method of determining two groups of impurities in tellurium of high purity, based on an activation analysis. A. I. Busev and V. M. Byr'ko (Moscow State University) studied a reaction on the substitution of complex pyrazoline dithio carbamates and the possibility of applying these compounds for radiometric determinations. An interesting report

was given by K. B. Zahorenko and V. I. Korobkov (Moscow State University) on a method of determination of small amounts of uranium using nuclear emulsions. I. A. Korshunov and A. I. Shafiyev (Gorskiy State University) expressed their views on the composition of zirconium phosphate on the basis of radiometric titration. The report of I. P. Alimarin and I. P. Borzenskova (Moscow State University) described a highly effective method of extracting small quantities of biobium from rocks.

The reports of I. V. Golubtsov, Yu. A. Likhachev, and Ye. K. Bakov (Moscow State University) described new equipment and some improved types of apparatus. K. A. Petrzhak and R. V. Selletskiy (Leningrad Technological Institute) constructed a four-pi-counter for low activities.

A large portion of the conference as assigned to reports on problems of teaching methods of radiochemistry in higher institutions of learning and projects for standard radiochemical laboratories. At a special session devoted to this aspect reports were rendered by V. P. Shvedov (Leningrad Technological Institute), An. N. Nesmeyanov (Moscow State University), and An. N. Murin (Leningrad State University). Following the papers there was a discussion period in which many members of the Conference participated. A decision was reached at the final meeting.

The data of the conference has been published in the journal, "Radiokhimiya" (Radiochemistry), and in the present journal.

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