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MOSCOW CONFERENCE ON ELECTRON MICROSCOPY

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The first conference on electron microscopy held in the USSR, called by the Academy of Sciences USSR, took place at Moscow. Approximately 300 people participated in its work. The conference demonstrated the considerable progress made by Soviet electron microscopy during recent years.

More than 60 reports on original work were read. The work was carried out in the most varied fields of electron microscopy, such as construction of apparatus, use of electron microscopes in physics, metallography, biology, chemistry, and geology.

The conference noted great progress in the USSR in the field of construction of apparatus. As is known, the first work on the creation of electron microscopes was begun in the USSR about 15 years ago, at the Power Engineering Institute of the Academy of Sciences USSR and at the All-Union Institute of Experimental Medicine. In 1939, the State Optical Institute, on the initiative of S. I. Vavilov, who was at that time its director, turned to the creation of a more advanced design of the electron microscope. This work was carried out by V. N. Vertsner, Candidate of Physicomathematical Sciences, and Engineer-Designer N. G. Zandin, under the direction of Academician A. A. Lebedyev. By the start of World War II, the first microscope with a magnifying power of 10,000 had been constructed. Work on the creation of a USSR electron microscope was not interrupted during the war. As a result, a more advanced model was built at that time, and a government order for the production of the first five Soviet 50-kv electron microscopes was filled in 1946. In 1949, our industry began the series production of a perfected model designed by the State Optical Institute.

For creating the first USSR electron microscopes, Lebedyev, Vertsner, and Zandin were awarded a Stalin Prize in 1947.

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From the end of 1945 on, work on the creation of new designs of electron microscopes was centered at the Scientific Research Institute of the Ministry of Electrical Industry USSR. As early as 1946, a few experimental assignments of 100-kv electron microscopes (EM-100) were put out within the ministry organization. At present, a small-sized 50-kv magnetic electron microscope, a universal 100-kv electron microscope, 50-kv electrostatic electron microscopes, an electron microscope with permanent-magnet lenses, an apparatus for preparing specimens, etc., have been developed at the Scientific Research Institute of the Ministry of Electrical Industry USSR under the direction of Academician A. A. Lebedyev.

The above devices have a number of valuable properties. For instance, the universal electron microscope, in addition to investigation of objects by transmission, also permits observation of objects by reflected electron beams, investigation of luminescent objects (in the electronic sense of the term), continuous magnifications from optical to superoptical without disturbing the vacuum in the microscope, and study of the same part of an object electromicroscopically and electronographically. The Scientific Research Institute of the Ministry of Electrical Industry USSR has developed a power-supply unit with high stability for electron microscopes of USSR construction.

As a result of the work of this institute and the State Optical Institute, many scientific research institutes and institutes of higher learning in our country are now equipped with electron microscopes of domestic manufacture.

It can be stated without exaggeration that, in regard to electron microscopes, of which there are more than 100 in the country at this time, the USSR holds one of the first places in the world.

In the past years, great expansion and development of the use of electron microscopes has been achieved in various fields of science and technology, such as physics, organic and inorganic chemistry, metallography, biology, and geology. In the field of physics, work can be noted on processes taking place at the electrodes (mainly the cathode) during gas discharge (Moscow State University imeni Lomonosov, Scientific Research Institute of the Ministry of Electrical Industry USSR), on electroerosion (Moscow State University, Khar'kov State University), in the field of electron-ionic microscopy of gases (Moscow State University), in electron optics (State Optical Institute, Academy of Sciences USSR, Scientific Research Institute of the Ministry of Electrical Industry USSR, Chernovitsy University), on the interaction of electrons with matter (Moscow Power-Engineering Institute imeni Molotov, Scientific Research Institute of the Ministry of Electrical Industry USSR), on the action of electrons on photo emulsions (Moscow Power-Engineering Institute), on emission and reflection microscopes, and in the field of electron-microscopic study of photocathodes (Scientific Research Institute of the Ministry of Electrical Industry USSR). Interesting results were attained at the Scientific Research Institute of the Ministry of Electrical Industry USSR in the development of a general method of electron-microscopic investigations (single-stage quartz imprints and imprints from wet objects were obtained).

In the field of chemistry, mention must be made of much work in the field of electron-microscopic investigation of catalysts performed at the Institute of Physical Chemistry of the Academy of Sciences USSR.

To this belong investigation by the method of imprints of active surfaces of bulk catalysts and of their changes during operation, investigation of the structure of the above catalysts and the role of creeping of atoms on the surface during their preparation and aging, study of the effect of the method of preparation on the structure of the catalysts, work on a method of repeated exposure of imprints from a definite submicroscopic portion of the surface, and work on composing topographic charts of active catalyst surfaces.

Of the other electron-microscopic investigations carried out at the Institute of Physical Chemistry of the Academy of Sciences USSR, mention should be made of work on the study of the topography and early stages of chemical reactions in the solid phase (pyrolysis of salts, photodecomposition of silver salts, etc.) as well as on the investigation of the structure of activated carbons and inorganic adsorbents. The Scientific Research Physicochemical Institute imeni Karpov made a study of particles of inorganic hydrosols and the contact angles of small drops. Special mention should be given to work connected with the electron-microscopic investigation of technologically important materials like carbon black (Institute of Physical Chemistry of the Academy of Sciences USSR, All-Union Scientific Research Institute of the Gas Industry), and crude rubber (Scientific Research Institute of the Tire Industry, Scientific Research Institute of the Ministry of Electrical Industry USSR, Institute of Physical Chemistry of the Academy of Sciences USSR).

With the aid of the electron microscope, investigations were conducted at the All-Union Institute of Aviation Materials in the field of metallography; for instance, of a better method for investigating the structure of metals (sighting method, method of orienting the sample, investigation of isolated phases, and other methods, as well as investigation of processes of separation /precipitation?/ in cast aluminum and special alloys). The Ural Affiliate of the Academy of Sciences USSR investigated the initial stages of separation in aluminum alloys, the mechanism of plastic deformation of aluminum crystals and the steel structures obtained in annealing and isothermic separation /precipitation/. The Ural Polytechnic Institute and the Ural Affiliate of the Academy of Sciences USSR jointly studied the smoke sublimates /films/ formed in steel furnaces. A study of special steels was made by the Steel Institute imeni Stalin.

Extremely variegated and successful investigations were conducted with the aid of the electron microscope in the field of biology. Mention can be made of a study of the mechanism of the action of lysis-producing agents on the bacterial cell (Laboratory of Electron Microscopy at the Department of Biological Sciences of the Academy of Sciences USSR Institute of Penicillin and Other Antibiotics), and a study of the structures of the plastids of plant cells in connection with their enzymatic activity (Institute of Biochemistry of the Academy of Sciences USSR). Work was done on the use of electron-microscopic methods in histology (Institute of Physiology of the Central Nervous System, Academy of Medical Sciences USSR, and the State Optical Institute), and a study was made of the structure of muscle proteins and collagen (Chair of Biochemistry of the First Moscow Medical Institute, Scientific Research Institute of the Ministry of Electrical Industry USSR). Research was done on erythrocytes (Institute of Biophysics of the Academy of Medical Sciences USSR), on the morphology of microorganisms (Institute of Microbiology of the Academy of Sciences USSR, Ural Affiliate of the Academy of Sciences USSR, and Sverdlovsk Oblast Tuberculosis Institute), and on the development of a method of drop dialysis (Laboratory of Electron Microscopy of the Department of Biological Sciences of the Academy of Sciences USSR). A study was made of methods for obtaining thin slices of tissue without special microtomes (Institute of Physiology of the Central Nervous System, Academy of Medical Sciences USSR), and for cultivating microorganisms on a supporting colloid film (Institute of Experimental Medicine of the Academy of Medical Sciences USSR).

Some interesting investigations were carried out with the aid of the electron microscope in the field of geology: study of the structure of argillaceous minerals, the composition of clays of various genetic types (All-Union Scientific Research Geological Institute), and domestic fertilizers (Institute of Physical Chemistry of the Academy of Sciences and Scientific Research Institute of Fertilizers, Insecticides, and Fungicides).

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Summing up the results of all this work, the confer[illegible] outlined a number of problems which are yet to be solved by scientists in [illegible] field.

The main task in the field of construction of equipm[illegible]t is the creation of electron microscopes which will allow investigation of the kinetics of processes. It is also necessary that electron microscopes be developed which will not only supply pictures of the object but also permit, by the method of electron diffraction, quick and exact determination of the structure of any area selected in it, of its composition according to the loss in speed of the electrons during their passage through the object, and, finally, of its electric or magnetic fields in the vicinity of individual grains by the deflection of the electrons. Tasks for our industry in the field of construction of equipment, considered absolutely necessary by the conference, are a considerable increase in the output of 100-kv microscopes, and series production of simplified, cheap microscopes (which could be supplied not only to large institutes, but also to school and factory laboratories), and of apparatus for the preparation of samples for electron-microscopic examination.

In the field of electron-microscopic investigation of the structure of metals, it is essential to develop improved methods of investigating the structure of complex alloys, the mechanism of deformation and disintegration of metals, the processes of dispersion separation in high strength and heat-resistant alloys, and the exact structure of hardened steels is essential.

For biology and medicine, the conference recommended wide use of electron microscopy in solving one of the most important problems of contemporary biology, namely, the problem of noncellular forms of living matter; expansion of electron microscopy to various fields of plant and animal virusology, to the study of the morphology of microorganisms, and to solving the problem of bacteriophages; also application of this method in cytological and histological investigations, in solving problems of a biochemical character, and above all in the study of the structure of proteins.

In the field of chemistry and geology, the conference considered it essential that a new trend of electron-microscopic investigation be developed (in chemistry: investigation of high-molecular compounds, of fibrous substances, and of proteins; in geology: investigation of microfauna, rock structures, etc.), and also, that work be done on the improvement of technological processes by means of wide introduction of the electron microscope as a method of investigation, control, and analysis at plants and specialized branch institutes. This concerns the investigation of the structures of rubber, which has already been mentioned, and investigations of the structure of carbon black, coal, phosphates, and clays, as well as to a number of other projects in which the electron-microscope methods may prove to be effective, such as the investigation of pigments, electrode materials, the structure of artificial fibers, cements, etc.

Considering the great spread of electron-microscopic investigations in the Soviet Union and their importance for Soviet science and technology, the conference petitioned the Presidium of the Academy of Sciences USSR for organization within the academy of a permanent commission on electron microscopy with the following tasks: coordination of work in the various fields of electron microscopy, issuing of reports, fixing the type and design of electron microscopes and accessory apparatus, the production of which is to be organized in our plants, etc.

At its last meeting, the conference heard a special report on questions of health protection in work with the electron microscope, presented by the Institute of Work Hygiene and Occupational Diseases of the Academy of Medical Sciences USSR and based on the investigation of voluminous factual material.

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