GLASS FIBER SYMPOSIUM

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On the 7th-9th February in Moscow the first symposium to be held in the Soviet Union dealing with glass fiber was set up upon the initiative of the scientific council, dealing with the problem "New technical materials based on glass and refractory materials" by the State Committee of the Council of Ministries, USSR, for science and technology, and also following a proposal from the 4th All Union conference on the glassy state. The organization of the symposium was the responsibility of VNII Glass Plastics and Glass Fiber, the All Union Association for the industry of Glass Plastics and Glass Fiber, the technical division of the Chemical Industry Ministry of the USSR and the Moscow section of the D. I. Mendeleev Chemical Society.

More than 200 scientists from 36 organizations of our country took part in the conference. The plenary sessions heard 43 papers and communications dealing with structure, composition, properties and forming of glass and inorganic fibers.

The symposium was opened by the chairman of the organization office, M. S. Aslanov.

In his opening address the director of VNIISPV, V. E. Sheiko, discussed the attainments of scientific research into glass fiber and the industry in the last 8 years. He stated that the high rates of growth in the glass fiber industry are to be maintained in the coming ten years and tasks have been formulated for creating new types of fiber and technical processes. A report entitled "Microstructure and properties of glass fibers obtained in different glass systems" was delivered by M. S. Aslanov. Investigations made by the author with his colleagues into glasses and glass fibers in very different glass systems and investigations of their properties failed to show any difference in the structure of the original glasses and fibers. Only the mechanical properties of the fibers, especially strength, showed any great differences. The author demonstrated that the relationship between the fiber strength and chemical composition of the glasses is very complex. In terms of strength, fibers of different glass compositions can be classified into three groups. The highest strength level is noted for fibers obtained from fused quartz and also from magnesio-aluminosilicate glasses whose strength in liquid nitrogen is as high as 1800 kg/mm² and approximately to the calculated strength of glass and quartz. It was shown that the decisive factor for fiber strength is the decisive state and the physical chemical reaction between surface defects and the surroundings. It was also shown that the microglass-crystalline structure is peculiar to high-modulus fibers, and to a less extent to certain types of semiconducting fibers. The microheterogeneous structure was revealed in fibers obtained from glasses tending to liquation, and also in fibers obtained from glasses with a certain content of silica. Accumulated experimental information shows that real glasses and fibers used for practical purposes have a variety of structures. The speaker also examined the results of synthesizing fibers from infusible glasses and the properties of hollow fibers and porous fibers.

A large group of papers dealt with the synthesis of glasses and fibers in the systems: SiO₂-Al₂O₃ -CaO-MgO-TiO₂ (A. I. Ivanova, S. Z. Vol'tskaya, K. F. Krinova, Z. A. Levtsova), SiO₂-PhO-TiO₂ -BaO-SrO (A. I. Ivanova, K. F. Krinova), vanadium glasses (M. S. Aslanov, M. A. Yakovleva) iron-containing glasses (N. N. Ermolenko, E. P. Rusetskaya, M. P. Grishina), SiO₂-TiO₂-B₂O₃-Al₂O₃ -CaO (N. N. Ermolenko, Z. F. Manchenko), CaO-MgO-Al₂O₃-SiO₂ (S. F. Zhiltkevich, Yu. I. Kolesov), the influence of BaO, ZrO₂, TiO₂, MgO and certain other oxides on the properties of nonalkaline glasses (M. A. Matveev, E. E. Mazo, L. K. Ushakova, F. T. Zhos, A. I. Brazgovskaya). Fibers have been synthesized possessing high mechanical strength, high dielectric constants, chemical and temperature resistance, and possessing semiconducting and protective properties.

The physical properties of microcrystalline fibers (softening temperature and sintering temperature, modulus of elasticity, density, refractive index and strength) and their changes during
crystallization were examined in a paper by M. S. Aslanov and Z. I. Shinia. The influence of the covalency of the chemical bonds on the ultraviolet and infrared spectra in the fibers was studied by R. S. Shevelavich, V. N. Tabrin, and E. G. Gainullina.

A number of papers dealing with the structure and strength of glass fibers were presented by the solid state physics department of the V. I. Lenin MGPI institute – G. M. Bartenev, A. B. Sidorov, L. I. Motorina. G. M. Bartenev considers glass fiber to be a suddenly frozen thermodynamically unstable system whose structure inside the glass fiber differs from that on its surface. The surface layer approximately 0.01 μ thick possesses outstanding mechanical strength. The strengthening takes place during the formation of a layer longitudinal to the axis of the fiber, as a result of a sudden stretching of the layer and molecular orientation of the structure. A. B. Sidorov examined the statistical theory of the strength and influence of various factors on the strength properties of glass fibers during thermal processing.

The symposium members were presented with the results of investigations into fiber optics. The viscous flow of sintered fiber in the softening and annealing regions was investigated by S. V. Nemilov, V. M. Polukhin, N. V. Romanova, and viscous flow under tension by M. P. Alekseenko, Yu. V. Khabarov. The peculiarities of thermal expansion of optical factors were dealt with by M. S. Gomel'tsk, V. N. Polukhin, and the possibilities of using optical fibers as lasers by R. S. Shevelevich, V. N. Mitsae. V. I. Babanin discussed the temperature stresses in optical fibers and light guides and their strength.

The various properties of basalt fibers have been investigated in the Ukraine branch of VNISPV: the influence of heat processing on the acid resistance (M. S. Aslanov, A. A. Myasnikov), the nature of the high thermal-shock resistance (V. A. Dubrovskii, M. F. Makhova), the chemical resistance (T. S. Dubrovskaya, N. E. Kosmina), the resistance to the action of drainwaters (V. A. Dubrovskii and V. A. Rychko),

The role of glass fibers of different composition in the adhesion of thermosetting plastics was discussed by G. A. Andreevska, Yu. A. Gorbatkina, V. G. Ivanova-Mumzhieva and E. V. Zaborovska.

The symposium paid a lot of attention to the forming of glass and inorganic fibers. The review presented by M. G. Chernyak dealt with the main trends in research into fiber forming.

Experimental investigations of the forming process for continuous glass fibers have been covered in investigations of: the influence of the physical-chemical properties of glass on the forming process (M. D. Khodakovskii, S. S. Kutukov, M. S. Aslanov), the influence of hydrostatic pressure and glass currents in the vessel on the forming process (B. I. Baskov, S. S. Kutukov, M. G. Chernyak), the principles of fiber-forming using low viscosity melts (M. P. Cherkasov, M. S. Aslanov), the possibility of speeding up the forming process (M. D. Khodakovskii, A. N. Zolotov, S. S. Kutukov).

An attempt to give a mathematical description of fiber forming as a transition process was made by R. S. Shevelevich and Yu. A. Kluychkov. V. I. Babanin proposed an equation reflecting the shape of the gob formed during fiber formation. The theorem of the similarity theory was used in the paper of D. V. Fedoseev, V. A. Ryabov and P. S. Kiriev to explain the relationship between forming conditions and fiber diameter.

A new prospective experimental-statistical method for selecting the optimum industrial parameters was demonstrated for the rod method of forming (V. E. Khazanov, M. S. Aslanov) and the process of fiber forming with a hollow structure (S. S. Gordon, M. S. Aslanov).

A. Ya. Raskin and É. R. Nigin demonstrated the great possibilities of using impulse photography and high-speed cinematography for investigating the process of forming staple fiber. The use of these methods would permit us to investigate the mechanism of forming super-ultrafine fibers (V. N. Balashov, Ya. A. Shkol'nikov) and the mechanism of the centrifugal-die-blowing method for obtaining fiber (É. G. Nigin).

A number of papers gave the results of investigations of the influence of industrial parameters on the forming process of the jets of high melting point aluminosilicate melt (K. Ya. Sal'nikov, A. P. Galushkin, M. S. Aslanov) and staple fiber from this melt (A. P. Galushkin and V. I. Krys'tkov) and also on the process of fiber formation by vertical blowing method (E. P. Kochorov).