FIFTH ALL—UNION SYMPOSIUM ON POWDER METALLURGY

This Symposium was held in Moscow, September 26-29, 1960. It was organized by the Scien. Tech. Society of the Machine Building Industry jointly with the Institute for Powder Metallurgy and Special Alloys of the UkrSSR Academy of Sciences and the Committee for Automation and Machine Construction, Council of Ministers of the USSR.

Thirty-five papers were delivered on the theory of powder metallurgy, powder production, nature and properties of various powder products and new technological processes for making them. The lectures were based on researches conducted at various institutions and research organizations.

M. Yu. Bal'shin (Institute of Metallurgy, AN SSSR) spoke on the general laws controlling the compacting and sintering of metallic powders. He convincingly argued that the same laws control both pressing and sintering.

The very interesting report of Prof. G. A. Meerson (Krasnoyarsk Non-Ferrous Metals and Gold Institute) showed that the sintering process can be strongly activated and thus accelerated by using dispersed powders, temperature cycling and etching of the surface of particles. He pointed out the great importance of electrolytic production of copper, iron, tin and other powders. Until recently there was no basic theory describing the nature of powder production and the effect of various factors.

Prof. A. M. Levin (Ural Polytechnic Institute) explained the features of the (activated) process and analyzed its basic controlling factors.

The electrodeposition of metal is complicated by increasing alkalinity of the electrolyte near the cathode and the formation of hydroxides which effectively regulate the growth of metallic crystals. The effect of various production factors on the dispersion and other properties of the metallic deposits were pointed out and the peculiarities involved in obtaining of specific powders, especially iron, nickel, copper, silver, etc. were indicated.

In recent years, the fabrication of powder products from high-melting point compacts by infiltration with molten metals acquired considerable importance.

V. M. Eremenko (Institute for Metal Ceramics and Special Alloys, AN UkrSSR) explained the thermodynamic basis of physical-chemical principles of this process and demonstrated an equation characterizing the rate constant of the saturation process as a function of the activation energy and temperature.

Some leactures dealt with the manufacture of metal powders. Thus, Kudryavtsev and Mikhailov spoke on making highly dispersed iron powders by electrolysis. The best results were obtained from a solution of iron sulphate with additions of potassium sulphate. The optimum acidity corresponds to pH = 3-3.5. An apparatus was built to manufacture highly dispersed, homogeneous powder.

In a lecture by B. A. Borok and co-authors, a method developed by the Central Iron and Steel Research Institute for making powder alloys was explained. It is based on reduction of oxides or their mixture with hydrides. The method makes it possible to produce powder alloys based on Ni, Co, Fe, Cr, Tr, Mo, W and other metals.

Several lectures were devoted to various technological processes in powder metallurgy, such as pressing, sintering and finishing of powder products.

V. P. Lobashev described a method of obtaining large compacts from titanium and its alloys by hydrostatic pressing. Some of the equipment utilizes operating pressures as high as 1300 kg/sq. cm and can press slugs up to 200 mm dia and 1000 mm high (or even larger).

A. S. Sarvina described the manufacture of sintered piston rings from iron powder. The new technology involves eight operations, is very simple and the rings are better than cast ones.

The inherent porosity of powder metallurgy rings provides self-lubrication, a low coefficient of friction and a high wear resistance. Such rings increase the life of an engine by about 30%.

A. N. Filippov spoke on the manufacture of Al-base anti-friction materials. This is a very difficult problem, since aluminum powders form a dense oxide film which opposes the sintering of the porous materials.

Dr. I. V. Kragel'skii and associates reported on their work on metalloplastic friction materials. They developed a theory of dry friction especially suited for frictional materials. Much of the lecture was devoted to the effect and role of the so-called "third substance", i.e. the film formed on the surface of a frictional material. Based on this theory, frictional materials consisting of a combination of metals and plastics were produced and tested.

B. A. Borok and V. G. Teplenko described interesting studies on the manufacture of parts from titanium, chromium and vanadium (or their alloys) powders. Again, suitable manufacturing procedures were developed and materials not inferior to cast ones were obtained.

E. I. Pavlovskii spoke on metalloceramic filters based on iron particles obtained by atomization of wire. Various filter materials suitable for the oil industry were developed.

Other lectures dealt with the use of powder metallurgy for making various parts for automobiles and other machinery.

The results of the meeting can be summarized as follows:

1. The manufacture of metal powders and powder metallurgy parts has increased hundreds of times; research operations in this area have expanded considerably.

2. Many plants are now interested in powder metallurgy and its practical application.

3. New materials, such as frictional substances on iron and aluminum bases, SAP, anti-friction materials based on aluminum, porous sheet materials, heat-resistant, magnetic, and high-melting point materials are prepared in this manner.

However, there are also various deficiencies:

1. No centralized production of metal powders or powder products exists and the cost of powders is still high.

2. There is no systematic production of equipment for powder metallurgy needs. This prevents the organization of metal powder and powder parts production on a proper technical level.

3. The scientific personnel is dispersed in various organizations and there is not enough exchange of experience.

The Symposium passed a resolution in which various practical moves directed towards advancing the development of powder metallurgy in the USSR were suggested. Recommendations were made with regard to the manufacture of the necessary equipment, conducting research work, creation of a special powder metallurgy research institute as well as a specialized journal in this area. [The first volume of which appeared in 1961. T.N.]

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