PTFE DISTRIBUTION ACROSS THE WALL THICKNESS OF AN IMPREGNATED POWDER METALLURGY BUSHING

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Today metal-polyfluoroethylene bearing materials are being increasingly used in industry. The high antifriction properties of PTFE manifest themselves particularly clearly in combination with porous powder metallurgy materials. The antifriction properties of metal-plastics bearings depend largely upon the extent to which the pores of their metallic skeleton, especially those adjacent to the working surface, are filled with a polymer [1].

The present work was undertaken with the aim of determining PTFE filling parameters for a porous skeleton and studying the distribution of PTFE across the wall thickness of powder metallurgy bushings impregnated with a polyfluoroethylene suspension by the method of application of excess pressure. Impregnation was performed in the apparatus represented diagrammatically in Fig. 1. The apparatus consists of the pneumatic cylinder 2 supplied from a compressed air system. The pressure is regulated by the Kalibr filter unit 1 fitted with a pressure stabilizer. The compressed air pressure is transmitted through the piston 3 and the ram 4 to generate a pressure in the hydraulic cylinder 5, into which the impregnating substance is forced or poured.

The increase in pressure in the hydraulic cylinder compared with the pneumatic cylinder is given by the ratio of the effective surface areas of the two cylinders. The bushing 9 being impregnated is held by the screw 6 in the casing 7. Sealing is effected with lead washers. By employing simple attachments, it is possible to impregnate bushings from the outside or flat components. Impregnation pressures of up to 150 kg/cm² are attainable. The impregnating suspension is poured into the vessel 8, from which it is forced by compressed air into the hydraulic cylinder, or may be poured directly into the latter.

To determine impregnation parameters and study the distribution of polyfluoroethylene in the bushing wall, sintered specimens were prepared from PZh2K iron powder * to GOST 9849-61 standard, manufactured by the Brovary Powder Metallurgy Factory (preliminary experiments had established that parts produced from coarse powders can be impregnated more effectively and exhibit better antifriction properties). Pressing was performed, using hand-operated experimental dies, to a stop. The bushings were sintered for 1.5 h in a hydrogen atmosphere at a temperature of 1050°C.

Specimens were prepared as follows: Their inside diameter and height were maintained constant at 25 mm, while their outside diameter was 34, 40, or 50 mm, giving D/d ratios of 1.36, 1.6, and 2.0, respectively. Depending on the reproducibility attained, each experiment was repeated three to five times. To determine the parameters of impregnation of porous powder metallurgy bushings under the action of excess pressure, a study was made of the effects of impregnation pressure and time on their impregnability, i.e., the degree of filling of open pores with PTFE. Experiments were carried out on specimens with different outside-to-inside diameter ratios (D/d = 1.36, 1.60, and 2.0) and different porosities (20, 30, and 40%). The true porosities deviated from the required values by not more than 0.5%.

In the study of the effect of pressure upon impregnability, values of pressure of 1.0, 2.0, 5.0, 7.5, 10.0, 15.0, 20.0, and 25.0 kg/cm² were employed. Specimens were held under pressure for 30 sec. The

*Coarse reduced iron powder of 98.0% min. purity – Translator.

Fig. 1. Diagram of apparatus for impregnation of powder metallurgy bushings with polyfluroethylene suspension. For description see text.

Fig. 2. Effects of pressure (a) and pressure application time (b) on impregnability of sintered iron bushings: 1) porosity $\Pi = 20\%$, $D/d = 1.8$; 2) $\Pi = 30\%$, $D/d = 1.36$; 3) $\Pi = 30\%$, $D/d = 1.6$; 4) $\Pi = 30\%$, $D/d = 2.0$; 5) $\Pi = 40\%$, $D/d = 1.6$. 

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Drain

Compressed air

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Impregnation pressure, kg/cm²

Impregnation time, sec

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Degree of filling of open pores

0.15 0.20 0.25 0.30 0.35

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