Polymers enhance design of hydrodynamic bearings

Dr Guy Pethybridge looks at how polymer materials have been applied to the field of tilting pad bearings.

Polymer materials can be applied in a number of ways to enhance the capability of hydrodynamic bearings. The commonest use is to increase the temperature capability of the bearing to handle higher process temperatures.

Polymer-lined thrust bearings have been a vital component in borehole electrical submersible pump systems where ambient temperatures are commonly in the range of 120–180°C. The great depth of the boreholes and the limited space available further increase the stringency of the application, with load requirements of around 8 MPa. Recent innovations have seen new applications operating with downhole temperatures in excess of 200°C.

This temperature capability can also be applied to gas turbines to reduce system costs. Here savings come from elimination of the post-operation lubrication system as the bearings can cope with the large thermal effect resulting from process heat soaking back along the shaft to affect the bearings.

Fig. 2. Polymer thrust bearing for water-lubricated applications.

Good surface properties have seen polymers flourish in applications where thin films are a given. This can result either from the type of lubricant involved, for example water and toluene, or from a conscious reduction in viscosity to minimise power loss. Bearings utilising ferrobestos have been well-established solutions for water-lubricated applications until being banned due to the asbestos content. Polymers strengthened with carbon-fibre, see Fig. 2, have been successful replacements for ferrobestos in hot water circulation pumps giving good wear resistance whilst running with high loads. Polymer-lined bearings have also been provided to run with other lubricants such as toluene and Freon to minimise sealing requirements and to benefit from the low power losses associated with low viscosity fluids.

Polymers have been successfully applied in hydrodynamic bearing solutions, however, it is still just as vital to ensure that the whole environment of the bearing is given careful consideration. Well-directed flow paths are still required to supply sufficient lubrication and lubricant cleanliness will always remain an important factor. Hence, materials knowledge, bearing design and applications experience are all requisite skills for the successful exploitation of alternate materials. ❑

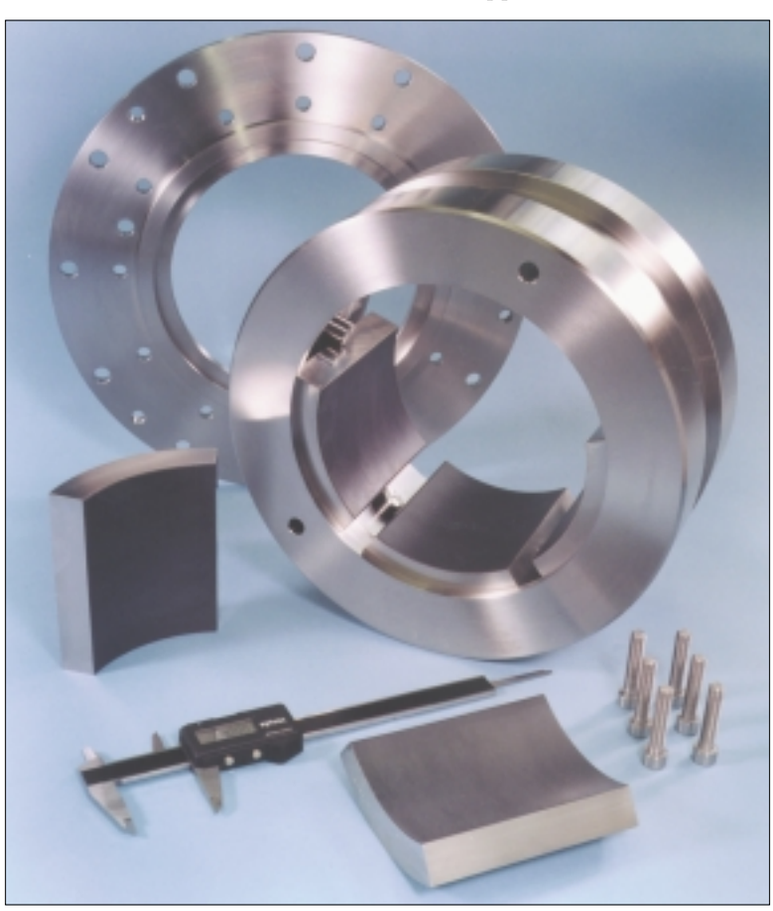

Fig. 1. Polymer-lined radial bearing for operation with amine as the lubricant.

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