Chapter 14

The Bearing Performance of Sintered Metal Bearings

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Introduction

Powder metallurgical techniques are used in the manufacture of a wide range of plain bearing types, which are used in a wide variety of applications. The vast majority of these bearings are based on copper alloys.

It is convenient to deal with the types of bearings which are based on or incorporate powder metals under five main headings.

1. Steel-backed materials with a compacted nonporous sintered lining for engine bearings and wrapped bushes.
2. Steel-backed materials with a porous sintered bronze lining impregnated with plastic to form a material suitable for dry operation or operation with only a limited lubricant supply.
3. Unbacked porous sintered metal parts impregnated with oil to form self-lubricating bushes or washers.
4. Unbacked nonporous sintered metal parts incorporating graphite for operation under poor lubrication conditions.
5. Sintered polytetrafluoroethylene (PTFE) parts incorporating powder metals for nonlubricated applications.

Of these five types of bearings (1) and (3) have been established for many years and sell in very large volumes, together in the region of $10^7$-$10^8$ parts per day. The other three types sell in
much smaller quantities - together approximately $10^5$ parts per day - in the specialized applications for which they were designed.

**The Evaluation of Bearing Performance**

The evaluation of bearing performance may be carried out at several levels:

1. On simple rigs such as the pin-and-ring machine. Usually the specimen under test is flat to avoid the necessity of forming into a bearing, and test conditions of sufficient severity are chosen to enable an evaluation to be made after a fairly short test duration of a few hours.

2. On more sophisticated rigs which simulate reasonably closely a range of practical bearing conditions. The specimen is an actual bearing and extended test durations are usually used.

3. On the actual engine or equipment in which the bearing is expected to operate, but with the equipment operating under controlled conditions.

4. On the actual engine or equipment operated under normal service conditions.

These approaches are in increasing order of certainty that the results obtained from the investigation will apply in practice, but this increased certainty carries with it the penalty of increased time before the results are available. If the field tests of category (4) are used it may be several years before meaningful measurements can be made. At the other extreme, the doubt attached to the simple accelerated tests of category (1) is such that a choice of bearing material based on such a test alone could be a wrong one. Prior correlation of the results from the simple test with a more sophisticated test or with actual practice has to be obtained, and obtained moreover for each class of material investigated.

In the author's opinion the most useful type of rig is that of category (2), and it is on this type of rig that many of the results described in this paper have been obtained. Rigs of this sort can be made sufficiently flexible for a wide range of practical applications to be closely simulated, and with a careful experimental technique results of good repeatability can be obtained. Although the bearing conditions may be slightly accelerated to enable the results to be obtained in a reasonable time, they should not be accelerated to the extent that the conditions bear no relation to practical conditions, for there is then the danger that the results will