Circulating Mechanism of the Oil in Brief Operating for the Oil-impregnated Sintered Bearing

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Abstract

The oil-impregnated sintered bearings are used for various aplecations and, wide usages without refueling. The oil circulating mechanism operates smoothly the behavior of oil If doing at the time of passing and becoming a stationary state, and there is little thing where trouble is caused. On the other hand, the trouble of such as starting noise might be caused in the unstationary state that repeats operation for a short time. To study the behavior of oil of each parameter, we execute the numerical simulation and various verification experiments. As a result, we developed that the bearings were able to be used enough for various brief operating time in the unstationary state. Finally we have expanded the usage of the oil-impregnated sintered bearings by adding the consideration of the behavior of oil.

Keywords : sintered bearings, oil-impregnated bearing

1. Introduction

The circulation of oil becomes insufficient in the operating condition in a brief time, and there is a possibility that the problem of the noises etc. occurs in the starting. It thought this to be the one based on the behavior of oil at clearance between the bearing and the shaft. Various complex parameters of operation conditions influence the behavior of oil. That is, the external specification such as the pressure, velocity, clearance, temperature etc., and the bearing specifications such as materials, oil-impregnated ratios and amount of oil. Therefore we especially paid attention to starting, and measured the outflow of oil and the frictional coefficient.

2. Experimental and Results

2.1 Experimental Procedures

The raw material powder used copper powder, iron powder, carbon powder, phosphorus powder, tin powder, and disulfide molybdenum powder. Table 1 and Table2 showed the development material, bronze material, and ferrous-copper material. The mixed powders were compacted into the shape of inner dia. 6 to 8mm at compacting pressure of 200 to 400MPa, and the cylindrical compacts were sintered at 973 to 1373 K. Then we prepared the specimen which has 22% intercominucating porositiy by sizing.

Table 1. Chemical composition of specimens

Material	Fe	Cu	Sn	C	P	Mo
Bronze	-	Bal.	9	0.5	-	-
Fe-Cu	Bal.	48	2	-	-	-
Developed	-	Bal.	9	0.5	0.4	2

The oil permeability, which is the pore state evaluated of the oil-impregnated specimen, is defined the pressure where bubble is generated which soaked was gradually pressurized by using air after the seal in the measuring method shown in Figure 1.

Table 2. Characteristic of the specimens

Material	Intercommunicating porocity (vol.%)	Oil permeability ($x10^{-3}$MPa)	Radial crushing strength (MPa)
Bronze	22	0.4	190
Fe-Cu	22	0.2	250
Developed	22	0.2	250

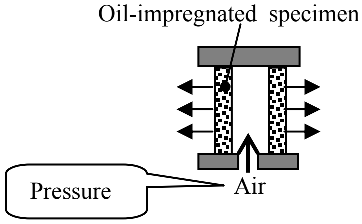

Fig. 1. Measuring method of oil permeability

The load and the rotation speed were changed and frictional coefficent was measured with the bearing performance testing machine. It especially paid attention to an initial change in the frictional coefficient and it experimented. Moreover, the oil that adhered to the shaft was observed directly by using oil additives with the the luminescence activator about the behavior of the oil of the clearance.

Figure 2 shows the observation of the oil that adhered to the shaft after it operates for a brief time at the low temperature.

2.2 Effect of solid lubricants

In the bronze materilal, when operating for a short time, the circulation of oil was insufficient, and caused the change of frictional coefficient at the time of passing as a result.

In the Fe-Cu system and the development material, the oil that adhered to the shaft was same level, but in the development material, an initial change in the frictional coefficient has decreased by the effect of the solid lubricants on carbon and disulfide molybdenum.

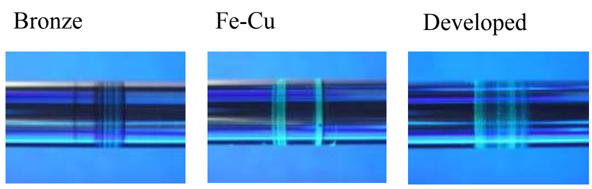

Fig. 2. The observations at shaft surface of samples

2.3 Optimization of the density

In addition, to evaluate the supply of oil to the shaft, we examined the optimization of the density. When the oil content is raised, the amount of the supply of oil rises, but oil film strength decreases, and cannot be supported the load from the shaft. Therefore we calculated oil film strength by the computer simulation, and then, decided the oil content.

2.4 Effect of the pore state of on side of outside dia.

Moreover, we examined the effect of pore state on side of outside diameter of bearing to clarify the behavior of oil. As a result, we verified that it is effective to reduce the porosity on side of outside diameter for the behavior of oil on the shaft shown in Figure 3.

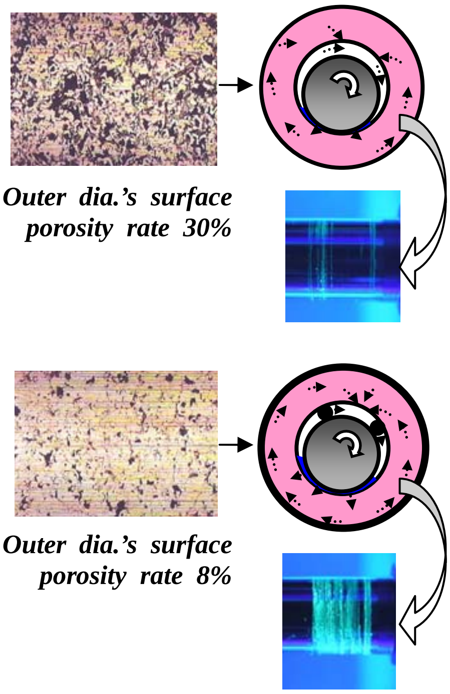

Fig. 3. The effect of porosity of outer dia. on oil supply

3. Summary

1. The addition of the solid lubricant is effective for the coefficient of static friction.
2. Pore control is practical to supply oil to the shaft with stability.
3. It is effective to reduce the porosity of the outer diameter for the supply oil to the shaft.

4. References

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