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PROCEEDINGS

Experimental Study on the Lubrication Enhancement of Slider-on-Disc Contact by Stearic Acid Adsorption under Limited Lubricant Supply

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ABSTRACT

The optimization of the lubricant supply quantity contributes to minimizing energy losses and wastage. Stearic acid is commonly used for boundary lubrication as an organic friction modifier. To enhance the performance of hydrodynamic bearings running with limited lubricant supply (LLS), under conditions of limited oil supply, the effect of stearic acid oiliness additive was studied on the relationship between oil film thickness of PAO10 (polyα-olefin) and inclination angle of the slider with an optical test rig for measuring the film lubrication in the slider-on-disc contact. The results showed that the film thickness presented an overall decrease with the increase of the inclination angle of the slider. The "dewetting" effect induced by the adsorption of stearic acid changes the lubricant distribution in term of the classical bi-side-ridge to discrete strip/droplet on the lubricating track, which improves the oil supply at the inlet of the contact and increases the thickness of the oil film. Particularly, the experiment found that the lower oil supply at low sliding speed actually induces abnormal higher oil film thickness. The adsorption of stearic acid makes non-wetting droplet-like oil accumulation in the inlet area, and the additional Laplace pressure formed increases the bearing capacity of the oil film. When the oil supply quantity is lower, the radius of curvature of the inlet lubricant accumulation is smaller, and the additional pressure is higher and so the film thickness increases. This study reveals a new role of stearic acid adsorption in promoting LLS lubrication.

KEYWORDS

Stearic acid; limited lubricant supply; inclination; film thickness; slider-on-disc contact

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