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Comparative Evaluation of MoS₂ and WS₂ as Powder Lubricants in High Speed, Multi-Pad Journal Bearings

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As part of a program to develop solid/powder-lubricated journal bearings, a comparative evaluation has been performed to aid in determining whether MoS₂ and WS₂ powder are suitable lubricants for high-speed, extreme-environment multi-pad journal bearings. Plots of traction coefficients, friction, frictional power loss, and bearing pad temperature are presented as a means for comparing various powder lubricants. This paper primarily focuses on experiments carried out on a three-pad journal bearing and a disk-on-disk tribometer. Results showed that MoS₂ traction curves resemble that of SAE 10 synthetic oil. Unlike liquid lubricants, powder films have a limiting shear strength property. Once the powder reaches this limiting value, the maximum traction coefficient is limited and the powder essentially shears along sliding walls. Experimental traction data shows evidence of this property in various powders. The thermal performance of the bearing was evaluated at speeds up to 30,000 rpm and loads up to 236 N. Although WS₂ displayed constant friction coefficient and low temperature with increasing dimensionless load, MoS₂ exhibited frictional behavior resembling that of a hydrodynamic lubricating film. In this paper, an attempt has been made to provide a criterion for the selection of solid lubricants for use in those tribosystems that may be operated in a high speed/load regime (i.e., high strain rates) as an alternative yard stick to conventional comparative approaches.