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Pin-on-Disc Tests of Pelletized Molybdenum Disulfide©

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The development of powder lubricated back-up bearings for magnetically levitated rotors operating under high speed, high temperature and even vacuum conditions is being investigated for Gas Turbine engines and Flywheel Energy Storage Systems. The objective of this work was to evaluate the performance of Molybdenum Disulfide as a solid lubricant via a series of tests using a modified pin-on-disc tribometer to examine the behavior of compacted pellets of Molybdenum Disulfide run against Titanium Carbide disc with respect to developing a powder pellet, which would provide adequate lubrication at the contact interface and also a low coefficient of friction. This paper reviews some recent advances in perfecting the solid lubricating film, in terms of wear and friction characteristics, particle size, level of powder compaction, bulk density, effects of external loading and transfer characteristics of the powder pellets. Some of the conclusions reached were that high compaction pressures which provided more stable pellet structure and high external loadings are often conducive to proper performance of powder layers.

KEY WORDS

Solid Lubricants; Molybdenum Disulfide; Powder Lubrication; Third Body; Quasi-Hydrodynamic Lubrication

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NOMENCLATURE

D	= pellet diameter (mm)
f	= friction coefficient
W_n	= external load on pellet (N)
$L\rho$	= length of pellet (mm)
L	= wear distance traveled (km)
N	= rotational speed (rpm)
P_d	= particle diameter (μm)
U	= linear speed (m/s)
$LVDT$	= linear variable differential transducer
MoS_2	= molybdenum disulfide
TiC	= titanium carbide
σ_{cc}	= compaction pressure (MPa)
δ	= RMS Surface Roughness, μm
ρ	= density, g/cc
Q_s	= side flow
Q_e	= end flow
Q_{in}	= inlet flow