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PERFORMANCE EVALUATION OF HALF-WETTED HYDRODYNAMIC BEARINGS WITH DLC COATED SURFACES

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ABSTRACT

In conventional liquid lubrication it is assumed that surfaces are fully wetted and no slip occurs between the fluid and the solid boundary. Under the "no slip" condition the maximum shear gradient occurs at the fluid-surface interface. When one or both surfaces are non-wetted by the fluid, boundary slip can occur due to weak bonding between the fluid and the solid surface, which reduces shear stresses in the fluid adjacent to the non-wetted surface. A thrust bearing tribometer was used to compare the performance of "no slip" hydrodynamic thrust bearings with bearings surfaces that were made to slip at the interface between the surface and fluid. Hydrophobic surfaces on both runner and bearing were achieved with the deposition of hydrogenated diamond like carbon (H-DLC) films, produced by plasma-enhanced CVD on titanium alloy surfaces. Hydrophilic surfaces were created through the surface modification of DLC. A mixtures of water and glycerol was used as the lubricant. The tests were conducted using different constant bearing gaps. The normal load and the torque or traction force between the rotating runner and hydrodynamic thrust bearing were measured with load cells. The experimental results confirmed that load support is still possible when surfaces are partially-wetted or non-wetted.