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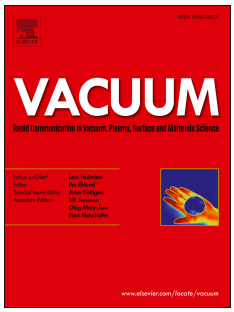

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Design and Development of Large Radial Clearance Static and Dynamic Magnetic Fluid Seal

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Abstract

A large radial clearance (0.7mm) static and dynamic magnetic fluid seal is designed and its performance is tested. The radial clearance of 0.7 mm is quite higher than the most of the commercial seals which have maximum radial clearance of 0.3 mm. Hydrostatic magnetic fluid "plug" is created in 5.94 mm glass tube and it is tested for various plug heights with respect to the pole piece height. Results show that as plug height increases the pressure holding capacity increases and then for optimum fluid height it becomes maximum. The increase in fluid magnetization also increases the pressure holding capacity of fluid plug. Using these results the dynamic seal having a large radial clearance (0.7mm) is designed and simulated using FEMM. The prototype test set-up is fabricated with multiple magnetic sources for 0.7mm radial clearance between the rotating shaft (DIA: 25 mm) and the pole piece. The seal assembly is tested for transformer oil based magnetic fluid for variable speed and the number of stages under vacuum pressure of 10^{-3}mbar. Results show three stages are sufficient to achieve 10^{-2}mbar pressure difference at 1500 rpm. Such seal can work as the bearing protection in low vacuum devices.

Keywords: magnetic fluid; rotary seal; vacuum pressure; hydrostatic loading