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Foil Gas Bearings for Advanced Oil-Free Turbomachinery Systems: Past, Present and Future

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要旨

Foil gas bearings are revolutionary technology that replaces traditional oil lubricants with ambient gas permitting great increases in operating speed, temperature and efficiency of machinery. Foil bearings are enabling many emerging Oil-Free turbomachinery products such as microturbines, blowers, turbochargers, auxiliary power units (APU's) and turbine propulsion engines. To use foil gas bearings in new machines one must combine good machine design, bearing design, and a series of test steps to minimize the risk of failure. In addition, foil bearings require solid lubrication to prevent friction and wear during initial start-up and shut down prior to lift-off and the development of a hydrodynamic fluid film. Foil bearings cannot be directly substituted for conventional bearings in an existing machine because the bearing properties are too different. Thus all new machines must be built.

This lecture introduces foil bearing technology as well as the key solid lubricant and machine design features needed to develop successful Oil-Free systems. Examples of current, newly emerging and future Oil-Free machines are discussed with particular emphasis on helicopters, lunar/mars power stations and deep space exploration propulsion. The effects of gas properties on bearing performance are explained and the unique test machines and capabilities at NASA are described. Future needs and remaining technical challenges for foil bearing research are explored and presented.

Keywords: solid lubricants, coatings, friction, wear, high temperature, turbines, foil gas bearings, space power.

http://www.grc.nasa.gov/WWW/StructuresMaterials/TribMech/research/D_OilFree.html

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