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LOW-FRICTION WEAR RESISTANT COATINGS FOR HIGH-TEMPERATURE FOIL BEARINGS

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ABSTRACT

Compliant foil bearings offer many advantages over rolling element bearings in high-speed and high-temperature applications. However, implementation of foil bearings in these applications requires development of solid lubricant coatings that can survive the severe operating conditions encountered at high speeds and high temperatures. The objective of this paper is to present results on development of an advanced coating system for use with compliant foil bearings that permits higher operating speeds and temperatures. In order to evaluate the coating performance and to select the best coating combination for implementation, a number of tests were conducted using a high-temperature, high-speed tribometer up to 810 °C. Inconel test substrates, representative of a portion of a foil bearing, were coated with several different Korolon™ coatings. The counterface disks were coated with four different hard coatings. The test results confirmed the excellent tribological behavior of Korolon™ coatings for high-speed high-temperature foil bearing applications. While the tribological behavior of Korolon™ coatings was determined to be a function of temperature, in most cases a maximum coefficient of friction less than 0.1 was observed during startup/shutdown periods. Subsequently, a foil journal bearing was designed and a composite Korolon™ coating was applied to the bearing top foil; and a dense chrome coating was applied to the journal surface. The foil bearing was installed in a turbojet engine and operated successfully to 54,000 rpm for over 70 start-stop cycles. Keywords: coating, foil bearing, wear resistant, high speed, high temperature.