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VIBRATION SIGNALS ANALYSIS FOR SOLID LUBRICATION OF ROLLING BALL BEARINGS

Abstract

Lifetime and reliability of spacecraft is largely dependent on the performances of moving parts, the evaluation of which have therefore been a crucial component of the research of space mechanisms. As for the applications with long life of more than several years, what we care about is not only the lifespan, but also the degradation process of the performances. At present, friction torque is mainly used to monitor the online behaviors of rolling ball bearings of solid lubrication. However, the dynamic friction torque exhibits a relatively stable range for a quite long time until it reaches the inflexion point which means the life end of bearings, and the corresponding results show very few information about the degradation process of the performances. Recently, we developed the technique for the measure of online vibration signals with the rolling ball bearings 708C lubricated by sputtering MoS2 films. To investigate the running process of the bearings, various tests were performed in atmosphere of N2. In a typical test, axial load (3kg) and rotation speed (1500rpm) were employed as parameters. The resulting time-domain curves indicated that the fluctuations of acceleration were gradually aggravating, and the maximum value increased from 0.7m/s2 to 1.2 m/s2, while friction torques (the value of voltage) continued to keep a minute variation. The resulting frequency feature curves (not shown here) proved that the acceleration value at 8.9 kHz experienced an abrupt decrease from 0.5m/s2 to 0.2 m/s2, which indicated that the balls might be running in some failures. And the corresponding inflexion point coincided with that of the friction torques. To further understand the degradation process of the rolling ball bearings of solid lubrication, the wear surfaces in various running stages were analyzed by using a combination of techniques including SEM, TEM and XPS, the results demonstrated that there was a long process for the degradation of the lubricating surfaces, and followed by an abrupt collapse.