MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Specialised Technologies, Including Nanotechnology (8)

Author: Mrs. Lixia Huo
China Academy of Space Technology, China, huolixiawin@163.com

Prof. hui zhou
China Academy of Space Technology (CAST), China, zhouhui510@sina.com

STUDY OF BONDED SOLID FILM LUBRICANTS FOR SPACE STATION LONG TERM LUBRICATION

Abstract

Bonded solid film lubricants have been used for numerous satellite mechanical components. But future Chinese Space Station Mission put increasing demands on the lubrication requirements for trouble-free service, such as long-life, high load-carrying and atomic oxygen resistance. The objective of this paper is to discuss the future technical requirements and evaluted four kinds of bonded solid film lubricants for high-cycle space station applicants. Three of the lubricants were bonded molybdenum disulfide based solid film lubricants for vacuum, the other one was bonded polytetrafluoroethylene based solid film lubricant for the cosmonauts living environment. The routine technical data including curing temperature, workable temperature range, outgassing properties, load-carrying capacity and adhesion of polyamideimide bonded, sodium silicate bonded and a duplex bonded molybdenum disulfide based solid film lubricants were compared. The wear lifetime of the three kinds of lubricants were studied by a ball-on-disc tribometer in vacuum at 920 MPa contact stress. And the effects of the atomic oxygen on the lubricants were also discussed, the accumulative total dose of the atomic oxygen which corresponds to 15 years in low earth orbit is 7.83E+26 atom/m2. The total dose of ionizing radiation in space for 15 years were equivalent to 9E+6 rad(Si) Co60 gamma exposure in air, but the effect of the radiation on the lubricants must be tested at the dose of 2E+7 rad(Si) rigorously. The duplex bonded molybdenum disulfide based solid film lubricants revealed advantages among the three kinds of film lubricants. On the other hand, the hygrothermal effects on the polyamideimide bonded polytetrafluoroethylene based solid film lubricants which would be used in the cosmonauts living environment were also considered. The film lubricants were exposed to a highly aggressive humidity durability test; test conditions were 80 degree centigrade and 95% relative humidity for about 2000 hours. All these test results will be the guide of designing long-life lubrication systems and chooseing appropriate bonded solid film lubricants for the space station components.