MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Environmental Effects and Spacecraft Protection (6)

Author: Dr. Koji Matsumoto
Japan Aerospace Exploration Agency (JAXA), Japan, matsumoto.koji@jaxa.jp

Mr. Mineo Suzuki
Japan Aerospace Exploration Agency (JAXA), Japan, suzuki.mineo@jaxa.jp
Dr. Satoshi Takada
Japan Aerospace Exploration Agency (JAXA), Japan, takada.satoshi@jaxa.jp

TRIBOLOGICAL PROPERTIES OF PTFE COMPOSITE IN LUNAR EXTREME ENVIRONMENT

Abstract

Activities on the moon are one of the next targets of space development. The Japan Aerospace Exploration Agency (JAXA) will also progress to research and development on a subsequent explorer following Kaguya and observation and experimentation systems. The next steps for lunar exploration are landing and moving on the lunar surface. The moon is covered by large amounts of dust particles, called regolith, which should make serious problems for tribological component on the moon. Moreover, for activities on the moon, not only tribological parts sealed from dust particles but also some parts exposed directly to the dust environment will be necessary (e.g. crawlers, wheels of rovers). In addition, temperature cycle on the moon also affects such parts. However, effects of the moon dust particles and temperature conditions on parts in vacuum have not been clarified. Acquisition of data about legolith effects is necessary. In this study, several PTFE composites and other polymer composites were evaluated to apply them as lubricants for exposed parts and/or materials of seals. Wear and friction behavior with a lunar dust simulant were compared using a tribometer. Configuration of the tribometer was designed to restrain dust particles from leaving the contact area easily. A roller specimen contacts and rotates against an arch-shaped specimen. The lunar soil simulant of 5 mg, with a certain particle size, was put around the contact area of the arch-shaped specimen. Friction tests were started by putting a rotating roller specimen on an arch-shaped specimen with an applied load of 10 N. Sliding speed was 15 mm/s and the test duration was 500 rotations of the roller specimen. To simulate lunar surface environment, temperature of the specimens were controlled from cryogenic condition to high temperature. Almost of the PTFE composites showed good wear resistance and low friction coefficient against lunar soil, and it could be kept in low temperature condition. Details of the results of the tribological properties in lunar extrme environment will be reported.