

## APPLICATION OF PEEK COMPOSITE TO SLIDING MECHANISMS IN SPACE

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### KEYWORDS

*Space tribology; Solid lubrication; Experiments in tribology; PEEK composite*

### ABSTRACT

The application of resin materials and their composites to sliding parts for use in space has recently increased. The utility of engineering and super-engineering plastics extends to such mechanical components as hinges, sealing systems for lunar regolith, and sliding bearing. Polyether Ether Ketone (PEEK) is a thermoplastic polymer containing an ether and a ketone group and is regarded as a super-engineering plastic. It has been widely applied due to great advantages of its heat resistance and mechanical strength. However, the need for sliding parts in space mechanisms has never been greater. In this study, possibility of use of PEEK composites as sliding materials for extreme space environment was evaluated.

The tribological properties of a PEEK composite, consisting of a carbon fiber reinforcement and PTFE additive, were evaluated by a roller-on-plate friction test. The test was conducted in a vacuum at cryogenic conditions and at high temperatures, and the results were compared with those of PTFE composites, used in space. Additional tests on the PEEK composite were carried out with a seal system and sliding bearing configurations in a vacuum.

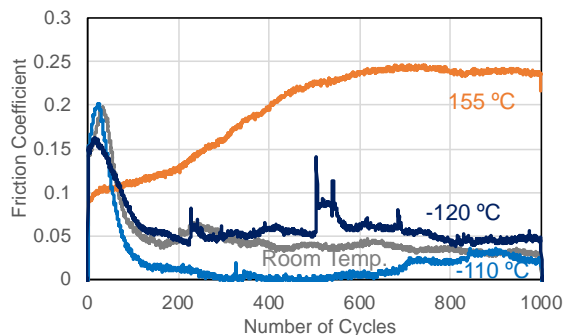


Fig.1 Friction behavior of PEEK composite in vacuum

Figure 1 shows the results of the roller-on-plate friction test as friction behaviors of the PEEK composite in a vacuum for different temperatures. Under both room and cryogenic temperatures, the PEEK composite showed a lower friction coefficient than PTFE composites in a stable state, although it was high at the beginning of the test. A running-in process seems to be needed to apply the PEEK composite. On the other hand, a high friction coefficient was obtained at high temperatures. Wear was measured after the friction test with a fixed number of rotations. For the PEEK composite, it was slight at all temperature ranges and smaller than for PTFE composites. The wear of the PEEK composite was larger at low temperatures than at high temperatures.

XPS analysis was carried out on the counterpart roller specimens after the friction test to determine the thickness and chemical components of the transfer film. Detection of fluorine, likely from PTFE, was higher at high temperatures than at room and low temperatures. Carbon was also detected on the counterpart wear track tested at high temperatures and was believed to be transferred from PEEK material. This much transfer material might be relevant to the elevated friction behavior at high temperatures.

Tribological properties of the PEEK composite under different conditions and characteristics of a few machine elements using the PEEK composite will be reported.

### ACKNOWLEDGMENTS

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### REFERENCES

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