OS8 (4) - 15 (OS08W0193)

Sliding Wear of Silicon Carbide and Silicon Carbide - Graphite Composite Ceramics

You Zhou, Synergy Materials Res. Center, National Inst. of Advanced Industrial Sci. and Tech., Nagoya, Japan
Kiyoshi Hirao, Synergy Materials Res. Center, National Inst. of Advanced Industrial Sci. and Tech., Nagoya, Japan
Yukihiko Yamauchi, Synergy Materials Res. Center, National Inst. of Advanced Industrial Sci. and Tech., Nagoya, Japan
Shuzo Kanzaki, Synergy Materials Res. Center, National Inst. of Advanced Industrial Sci. and Tech., Nagoya, Japan

Silicon carbide has attractive physical and mechanical properties and chemical stability, which enable it to be an ideal candidate for applications involving sliding or rolling contacts at high temperatures or in severe environments. However, its friction property is rather poor under unlubricated sliding contacts. One possible way of improving its friction property, viz., lowering the friction coefficient, would be using solid lubricants such as graphite. However, it is still not clear how the tribological property would change upon adding graphite into silicon carbide ceramics.

In this study, a monolithic SiC ceramic and two SiC-C composite ceramics containing 10vol% and 20vol% graphite were prepared. The friction and wear behaviors of these materials were evaluated by sliding against sintered silicon carbide under dry conditions using two tribometers: block-on-ring and pin-on-disk, where wear occurred under low and high contact stresses, respectively. For all the three materials, under low stress, worn surfaces were smooth and wear processes were dominated by tribochemical reaction; under high stress, worn surfaces were rough and wear processes were dominated by fracture and three-body abrasion. A lubricating effect of the graphite particles in the SiC-C composites was observed in all sliding tests. However, while the addition of graphite could concurrently result in a reduction in friction and an decrease in wear rate in the block-on-ring tests; the addition of graphite led to sharply enhanced wear rates despite the lowered coefficients of friction in the pin-on-disk tests. The cause for that difference was attributed to the effect of both the hardness of the materials and the contact stresses. (Research supported by METI, Japan, under the Synergy Ceramics Project.)