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# High mechanical and tribological performance of polyimide nanocomposites reinforced by chopped carbon fibers in adverse operating conditions

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## Abstract

In the present work, the effects of nano-SiO<sub>2</sub> and solid lubricants (SLs) such as PTFE and WS<sub>2</sub> on friction and wear behavior of polyimide (PI) composites reinforced by carbon fibers were investigated in extremely wide PV (the product of velocity and pressure) factors. The results showed that the nano-SiO<sub>2</sub> particles can reduce friction coefficient significantly under all conditions. Under low PV conditions, from the perspective of anti-wear property, the wear rate of SiO<sub>2</sub>/SLs/SCF/PI is remarkably reduced by the synergistic effect of nanoparticles and solid lubricants. Under PV value higher than 59.26 MPa·m/s, however, it performs poor anti-wear property, which mainly due to the deteriorated mechanical properties by incorporating solid lubricants and thermal instability of solid lubricants. However, the nanoparticles improve the wear resistance of SiO<sub>2</sub>/SCF/PI considerably especially under high PV conditions and the PV limit is got at 152.37 MPa·m/s. The protection of fiber-matrix interface by nanoparticles, the higher mechanical properties and high thermal stability of SiO<sub>2</sub> are responsible for the improvement of PV limit.

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