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Friction and Wears Behaviour of GFRP (Glass Fibre Reinforced Polymer)

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Description

The glass fiber and fly ash-reinforced monomer-cast nylon composites have been prepared by anionic polymerization of caprolactam. The friction and wear behaviors of composites with different proportions of glass fiber and fly ash under dry conditions and water lubrication were considered through a ring-black wear tester. A scanning electron microscope and a surface profilometer were used to examine and analyze the worn surfaces. The reinforcement influenced mechanical and tribological behaviors, and the orientation of glass fiber has an effect on friction behavior in reciprocating wear tests against silicon carbide abrasive paper.

Increasing the weight fraction of glass fiber decreases the coefficient of friction and increases the wear rate. For high weight fractions, the coefficient of friction is lower when sliding parallel to the glass fiber direction than when sliding perpendicular to the glass fiber direction. Scanning electron micrographs were used to depict the abrasive wear mechanism. In general, all test parameters such as applied load, sliding speed, sliding distance, and fibre orientations have a strong influence on friction and wear. Furthermore, it was discovered that applied normal load, sliding speed, and fiber orientations have a greater impact on wear rate than sliding distance.

The sliding velocity has a greater impact on sliding wear than the applied load, and variations in wear rate with operating time can be divided into three distinct periods. These periods are the running-in period, the steady-state period, and the severe wear period, respectively.

Reinforcement with fiber or filler significantly improves the tribological behavior of polymeric materials, but this is not always true. For steel-composites contact, there is a strong interdependence on the friction coefficient and wear loss with respect to the applied loads. Because the influence of vibration can cause significant change in this process, the friction process with vibration is an important practical phenomenon. Friction causes various types of vibration, and vibration affects friction in turn the decrease in the friction coefficient under vibration conditions, though some of the researchers have different views on whether friction force increases or decreases depending on the vibration parameters. Depending on the sliding pairs and operating parameters, friction can be increased or decreased.

Conclusion

The use of glass and carbon fiber in a nylon matrix improved the tribological and mechanical properties. Many factors influence tribological behavior, including the type, shape, size, and reinforcement of the fibers, the matrix materials used, and the test conditions under which the experiment is carried out. Fiber reinforced polymers are frequently used to improve tensile, impact, hardness, and tribological properties. As the loading increased, the tensile strength increased while the elongation at break decreased. The increased tensile strength of composites can be attributed to good adhesion between filler materials and the polymer matrix. The greater the binder (maleated polypropylene) loading in Kenaf fiber-homopolymer polypropylene composites, the better the mechanical properties for tensile and modulus strength, but the lower the elongation at break. Polymers have low wear resistance, mechanical strength, and thermal conductivity, so reinforcements and filler materials are mixed into the polymer to improve its tribological, mechanical, and thermal properties. Polymer applications are critical in the food and chemical industries because they eliminate the need for lubrication.