Polymer Composites. Vol. 46 (14), 2025, pages 12835 - 12846

Effect of elevated temperatures on wear and frictional performance of Pineapple Leaf Fiber-Reinforced natural rubber composites with the addition of multi-walled carbon nanotubes

Abstract

Rubber composites are often used at high temperatures, particularly in practical applications, such as autoclave components, gaskets, and seals. This study investigated the effect of elevated temperatures on the friction and wear properties of pineapple leaf fiber (PALF)-reinforced natural rubber (NR) composites with the addition of multi-walled carbon nanotubes (MWCNTs). Commercial NR composites were prepared using a two-roll mill mixing method, followed by molding. The PALF and MWCNTs contents were fixed at 30 and 10 parts per hundred rubber (phr), respectively. The frictional force, coefficient of friction (COF), and specific wear rate (SWR) were studied in the temperature ranges from room temperature (RT) to 80°C under various applied loads (5, 10, and 15 N). A significant improvement in the wear properties of the composites was achieved with increasing temperature. The results showed that the inclusion of MWCNTs effectively enhanced the wear performance of the composites at elevated temperatures. Overall, this study provides valuable insights into the friction and wear characteristics of PALF-reinforced NR composites with the addition of MWCNTs, enhancing their end-use properties for high-temperature applications. Highlights: Improved wear and frictional properties of NR/30PALF composites with MWCNTs. MWCNTs enhance heat dissipation, reducing softening at elevated temperatures. Frictional force and COF decreased with increasing temperature and load. NR/30PALF/MWCNT composites showed smoother surfaces and lower wear rates. Thermal stability and wear resistance of the composites were enhanced.

Keywords

elevated temperature; multi-walled carbon nanotubes (MWCNTs); natural rubber composites; pineapple leaf fibers (PALF); tribological properties