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UV-protection, tribology, and mechanical properties of ZnO-containing polyamide composites

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Abstract

Most polymer-based materials do not exhibit ultraviolet (UV) protection or wear resistance properties, thereby leading to poor packaging functions. This study provides an approach that simultaneously improves the UV protection and tribological functions of melt-processed polyamide (PA)-based composites by the addition of in-house produced hexagonal-shaped nano-zinc oxide (ZnO) particles. The 5 wt % ZnO-filled PA composite exhibited significant photodegradation protection (84%) with a well-balanced friction coefficient and wear resistance properties. The 1 wt % ZnO-filled PA composite also exhibited significant photodegradation protection (84%) but with a lower friction coefficient and strong wear resistance, while the 7 wt % ZnO-filled PA composite displayed strong photodegradation protection (94%) with poor wear resistance. The results suggest that owing to their UV stability and wear resistance, the low ZnO-filled PA composites show great potential as plastic materials in different applications such as active packaging. In addition, all the ZnO-filled PA composites exhibited improved mechanical properties relative to those of the neat PA.