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Abstract

Present work effectively highlights the improvement of flame retardant behaviour and thermal stability achieved through the incorporation of DOPO-functionalized SiO₂ nanocomposites into epoxy composites. The successful functionalization and existence of chemical bonding between SiO₂ nanoparticles and DOPO was confirmed using FT-IR and TGA. Among the varied weight percentage concentration of reinforcement used, 1.5 wt% DOPO-functionalized SiO₂ epoxy composites exhibited significantly improved thermal properties, including high char yield and enhanced glass transition temperature compared to those of neat epoxy matrix. Notably, the 1.5 wt %DOPO-functionalized SiO₂ reinforced composites possess V-0 ratings in the UL-94 vertical burn test, underscoring their remarkable flame retardancy, which further demonstrate the effectiveness of integrating DOPO functionality into the epoxy matrix. This integration significantly contributes to improved flame retardancy, confirming the potential of these modified nanocomposites for applications requiring enhanced thermal stability and flame retardant behaviour. The present study provides a promising approach for the development of advanced epoxy composites with superior fire safety characteristics, exploiting the unique properties of DOPO-SiO₂ functionalized reinforcements.