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RESEARCH ARTICLE

Enhanced mechanical, tribological, and acoustical behavior of polyphenylene sulfide composites reinforced with zero-dimensional alumina

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Abstract

Polyphenylene sulfide (PPS) is a semicrystalline thermoplastic which can pass UL94V-0 standard without adding flame retardant. In the present study, effect of alumina (Al_2O_3) addition on the mechanical, tribological, and acoustical behavior of PPS polymer were investigated. Experimental findings indicate that elastic modulus, tensile strength, and flexural strength were enhanced by 21.4%, 7.7%, and 6.9%, respectively. The highest tensile strength was obtained when PPS was reinforced with 5 wt% Al_2O_3 while highest bending strength and toughness were obtained with 20 wt% Al_2O_3 . Reinforced composites encountered <5% and <14% mass loss when heated to 420 and 500°C, respectively. Lower filler concentrations (<5 wt%) had insignificant effect on the glass transition temperature (T_g) of the composite. Experimental results agreed well to Hashin–Shtrikman and Suquet predictions at lower filler concentrations since filler particles could be easily dispersed in the interstitial sites of PPS matrix without significant agglomeration. Besides, significant acoustic emission (AE) characteristic such as higher absolute energy rate was witnessed in Al_2O_3 reinforced PPS composites. The insights derived from this study are expected to open a new avenue of producing composites with high stiffness, strength, and significant AE events by using zero-dimensional fillers.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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