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ICAM[5]

Development and Validation of a Theoretical Heat Conduction Model across Polymer Composites with Spherical Inclusions.

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ABSTRACT

This paper reports on the development of a theoretical heat conduction model for polymers embedded with spherical inclusions. It also includes the experimental validation of the proposed correlation for estimating the effective heat conductivity of such composites based on the model. Composites are prepared with different proportions of pinewood dust and aluminum oxide reinforced in polyester resin and their effective thermal conductive are measured using Unitherm^{TM} model 2022 as per ASTM E-1530. These values are compared and are found to be in reasonably good agreement with the theoretical values obtained from the proposed correlation. Further, the study is extended to estimate the k_{eff} values for a number of polymer composites with epoxy/polyester as matrices and coir dust/wood-apple shell dust as particulate fillers. Similarly, composites with T_iO_2 and S_iO_2 reinforcement have also considered. This study reveals that the incorporation of micro-sized fillers greatly influences the heat transfer behavior of filled polymers. It also shows that the correlations developed and proposed in this paper perform well both for thermally conducting and insulating fillers.

Keywords: Polymer composites; Particulate filler; mathematical modelling; Effective thermal conductivity