Effective Thermal Conductivity of Metal Filled Polymer Composites

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A theoretical model for predicting effective thermal conductivity (ETC) of metal filled polymer composites has been developed. The present effort is based on the equivalent thermal resistors formed out of the phases in the form of parallel slabs and the resistor model approach has been applied. We know that a metal filled polymer composite medium is neither composed of slabs parallel to the heat flux nor perpendicular to it, yet the concept of the slabs is capable of predicting the maximum and minimum limits of the ETC. Therefore, we assumed that the slabs of the continuous and dispersed phases are inclined at an angle q' with the direction of heat flux. As simple averaging does not predict the ETC of real composite material correctly, hence, a different kind of weighted geometric mean is proposed. The expression for q has been obtained using data fitting technique by simulating the results reported in the literature. An effort has been made to correlate the angle of inclination q in terms of the ratio of thermal conductivity of the constituents and the physical porosity. Best-fitted expression so obtained for q is presented here. Good agreement has been observed between estimated results with experimental data available in the literature. Comparison of the proposed relation with different models has also been made.