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Modeling of the Effective Thermal Conductivity of Natural Composite Materials

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Insulation is considered one of the effective solutions to achieve energy savings in building and thermal energy storage systems. Better insulation having low thermal conductivity contributes significantly to new construction and retrofitting existing buildings. Numerous analytical expressions for estimation of effective thermal conductivity of composite materials have been proposed by several authors. Basic expressions apply to spherical filler particles but later models were developed to allow the inclusion of other particle shapes, the presence of particle coating and the interfacial thermal resistance. Models belonging to the class of effective medium approximations usually fail to predict the properties of a multiphase material close to and above the percolation threshold. In the present paper, a novel and efficient model was developed for predicting the effective thermal conductivity of the composite materials based of polymers matrix and natural fibers at different filler percentages. By introducing the relative radius as a parameter, the effective thermal conductivity can be predicted precisely when the thermal properties of filler and matrix are prescribed. The model employed the resistor network strategy to achieve a highly efficient prediction during the overall conductivity calculation. To verify this model, a wide range of composites were analyzed using lambda meter apparatus. The model-based simulation values showed good agreement with the experimental results. Moreover, a discussion on the effects of the newly-introduced parameter was given. Finally, the relationship between the fibers content percentage and the thermal conductivity of the composite was studied.

Biography:

Said Sair is a PhD candidate in Chemistry research and development at Hassan II university of Casablanca Morocco. His research interest is in the field of the use of natural resources in the reinforcement of composite materials for different applications including thermal insulation, the modelling of physical behavior of composite materials is one of those interests. His other projects include the uses of fibers treatments rejects in inhibiting the corrosion of metals and alloys.