# Numerical Modeling of the Effective Thermal Conductivity of Polymer Composites Filled with Conductive Hollow Particles

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Composite materials are widely used in heat transfer applications (radiator, hood, hose, cases of battery of electric vehicle, mould...). The thermal conductivity is one of the thermophysical properties used to quantify the thermal behavior of these heterogeneous materials. The addition of conductive filler in a polymer matrix is an effective way to increase the thermal conductivity of the polymer materials, as required by several industrial applications. The hollow conductive particles are a promising way for enhancing heat transfer within the polymer matrix composites. In this paper, the thermophysical properties of polymer composite materials were investigated using the finite element software COMSOL 3.5a. The epoxy resin was used as matrix filled with spherical hollow conductive particles. In the numerical study, the effective thermal conductivity was calculated using 3D elementary cell. The effect of the filler concentrations and contact resistance were numerically investigated. The relationship between the thermal conductivity, the wall thickness of the hollow particles divided by the sphere radius and the ratio of thermal conductivity between the two phases were also investigated. The numerical results show an increasing of the effective thermal conductivity with increasing of the wall thickness of the hollow particles. The effect of the contact resistance on the thermal conductivity of the composites was clearly demonstrated.