Nanoparticle shape and agglomeration effects on thermal conductivity of nanofluids: A 3D simulation approach

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ABSTRACT

Many research studies have been conducted to evaluate the effect of different nanoparticles on the properties of nanofluids and nanocomposites.[1-4] Yet, to our knowledge only a small number of studies has been focused on the effect of the nanoparticle shape and agglomeration on the thermal conductivity of nanofluids through 3D simulations of heat conduction taking into account the geometry and shape of nanoparticles. The present work aims to study the fundamental aspect of the effect of the nanoparticle shape on the thermal conductivity of nanofluids by developing 3D Representative Unit Cells as parts of an integrated 3D simulator. A high thermal conductivity of up to 3000 W/mK representing carbon-based materials will be selected. Straight and waved tubes as well as spherical particles will be investigated and a comparison will be made regarding the role of the particle shape, for different concentrations and agglomeration levels. In-house and commercial software will be used. Preliminary results elucidate the impact of long pathway formation in the nanofluid on heat distribution and predict an impressive change of the thermal conductivity that can enjoy practical use in numerous applications in medical technology and engineering, including thermal treatment, heat exchange devices, and membrane-based separations.

KEYWORDS: Thermal conductivity, Nanofluid, Nanoparticles, 3D modelling

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