Critical analysis of the thermal conductivity models for CNT based nanofluids

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Nanofluids are a new class of heat transfer fluids that use dispersed nanometre particles in conventional base fluids, with the appropriate size and volume fraction capable of inducing an anomalous enhancement in the effective heat transfer coefficient of the mixture. The literature abounds with studies on several nanoparticles to be used on nanofluids engineering. Among those, carbon nanotubes are continuously referred to as the most promising nanoparticle as to thermal properties are concerned. Despite that, these nanoparticles apparently seem to be the ones gathering less attention from researchers since little experimental and theoretical studies can be found. The latter might be explained by the difficulty encountered in modelling some of the mechanisms observed in these particular systems. In this paper, an exhaustive critical analysis to the predictive models currently available for thermal conductivity of carbon nanotubes based nanofluids is presented. To this end, a statistical analysis of the different models available was carried out and it enabled to select specific nanofluid variables as control factors namely particle geometry, volume fraction, temperature and base fluid. The statistical study undertaken highlighted a lack of confidence on the models available since there is no convergence on the results. The latter seems to occur due to poor quality data, resulting in limited generic models. Therefore, this study revealed that more parametric experimental analysis must be given to specific control factors, namely carbon nanotubes length and volume fraction (see Fig. 1), since this seems to present higher contribution to the analytical results.

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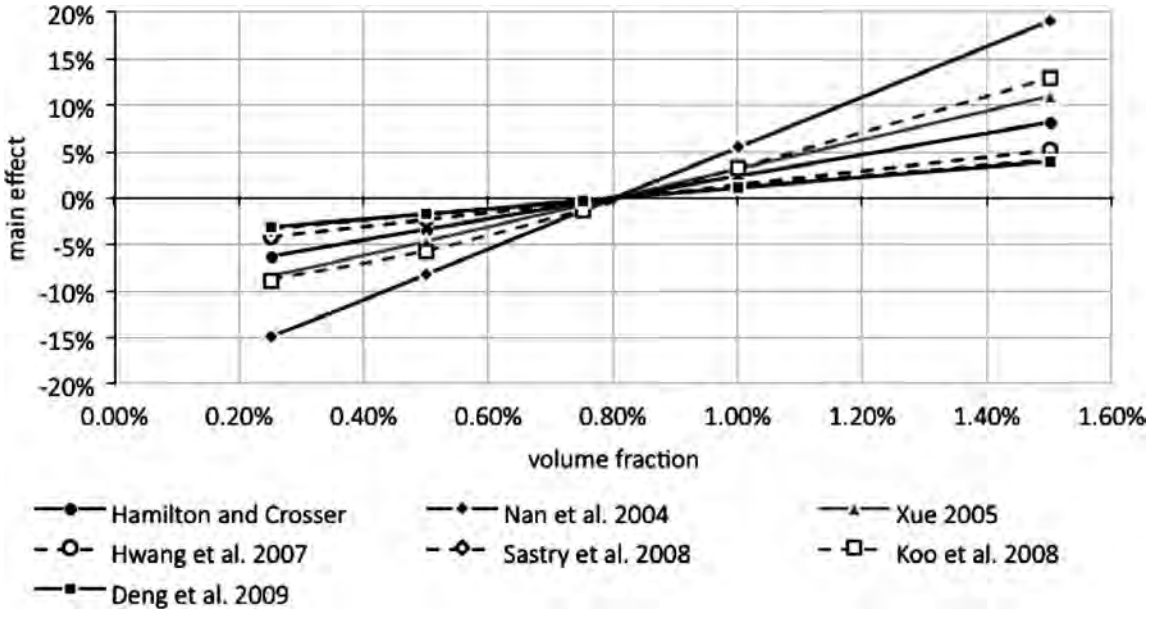

FIGURE 1
Main effect of the CNT volume fraction for the different predictive models analysed.