ABSTRACT

The enhanced heat transfer of nanofluids is shown not to be caused by the increase in thermal conductivity based on the concentration of nanoparticles (NPs) given by the long-standing Hamilton and Crosser (HC) mixing rules. Instead, heat transfer is enhanced because quantum mechanics (QM) restricts the specific heat of NPs to vanish, the consequence of which is that thermal kT energy absorbed from collisions of solvent molecules cannot be conserved by an increase in temperature. Conservation may only proceed by the QED induced up-conversion of the low frequency absorbed kT energy to the EM frequency of the NP, typically in the VUV. Here EM stands for electrodynamics, QED for quantum electrodynamics, and VUV for vacuum ultraviolet. The EM confinement is quasi-bound so that the VUV radiation promptly leaks from the NPs. Classical, collisions increase the NP temperature with EM emission occurring in the far infrared (FIR) that is absorbed with little penetration at the NP surface. But the VUV is absorbed at large penetrations, thereby enhancing heat transfer in proportion to the number of NPs without increasing the nanofluid conductivity - the process called QED induced heat transfer. Nanofluid conductivity given by the HC mixing rules for NPs in solvents is still valid and need not be modified.

REFERENCES