

Stability and characterization of CNT nanofluids using polyvinyl alcohol dispersant

ABSTRACT

In this research, CNT-water nanofluids are synthesized using polyvinyl alcohol (PVA) dispersant where each of the CNT concentration ranging from 0.01 to 0.1 wt% is tested with 0.25 to 3.00 wt% of PVA to optimize the dispersion and stability of nanofluids. The nanofluids are sonicated for 4 hours using ultrasonic water bath and the stability is analyzed using UV-Vis spectrophotometer. The dispersion state of the CNT-water nanofluid is further examined using optical microscope. The stable nanofluids of each CNT concentration identified were then tested for their thermo-physical properties such as thermal conductivity and viscosity with respect to temperature ranging from 25 to 70 °C. The results revealed that 0.5 to 1.5 wt% of PVA dispersant give the optimum stability to the entire range of CNT concentration studied. It was found that the thermal conductivity enhancement of CNT-water nanofluid stabilized by PVA increased non-linearly with temperature. Although PVA suppressed the thermal conductivity of water, the addition of CNT is able to surpass its effect and the results showed that there is approximately 1 to 44 % enhancement for the range of CNT concentration and temperature studied. It was also observed that the viscosity for 1.5 wt% of PVA aqueous solution at 25 °C is approximately 7.5 mPa.s, which is significantly greater than water. However, the presence of CNT nanoparticles is able to reduce the viscosity of its respective optimum PVA solution by 2 to 6% for the entire range of CNT concentrations investigated, showcasing self-lubrication effect of CNT. Moreover, the viscosity of the nanofluids decreases significantly with increasing temperature.

Keyword: Nanofluid; Carbon nanotube; Polyvinyl alcohol; Stability; Thermal conductivity