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Synthesis of *In-situ* Cu-CNT Hybrid Nanofluid and Study of their Thermophysical Properties †

Nikita Gupta [1], Shipra Mital Gupta [1,*], Surender Kumar Sharma [2]

[1] USBAS Guru Gobind Singh Indraprastha University, New Delhi 110078, India;
[2] USCT Guru Gobind Singh Indraprastha University, New Delhi 110078, India;
* Correspondence: shipra.mital@gmail.com (S.M.G.);
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Abstract: In recent years, numerous investigations have been carried out in heat transfer applications for CNT nanofluid due to its high thermal conductivity compared to conventional fluids. Effective dispersion of CNT in a polar base fluid is a challenging task because CNT is hydrophobic in nature. Researchers used stabilizers to overcome this problem, but the addition of surfactants has some disadvantages like foaming, stickiness, and increased viscosity, which ultimately increases the pumping power required to pump the nanofluid. Alternative methods for preparing effective nanofluid must be discovered. As a result, a hybrid nanofluid was synthesized. Cu-CNT hybrid nanoparticles were generated in this research using an *in-situ* synthesis of Cu nanoparticles in the presence of CNT nanoparticles and dispersed in double distilled water without surfactant to produce a stable nanofluid. The surface morphology of Cu-CNT hybrid nanoparticles was studied using FESEM with EDX and Raman spectroscopy. From FESEM with EDX, copper nanoparticles were identified on the outer surface of MWCNT, and Raman spectroscopy confirmed the covalent functionalization. Spectral analysis, Zeta potential, and DLS were used to evaluate the dispersibility of Cu-CNT hybrid nanofluid. The results showed that the samples were extremely stable, with maximum stability of more than 170 days. When compared to base fluid, nanofluid demonstrated a minor increase in density and viscosity, which is due to the addition of nanoparticles. An increase in thermal conductivity was also observed, which is critical for heat transfer applications.

Keywords: CNT nanofluid; stability; hybrid nanofluid; thermal conductivity; Zeta potential; heat transfer.

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Conflicts of Interest

The authors declare no conflict of interest.