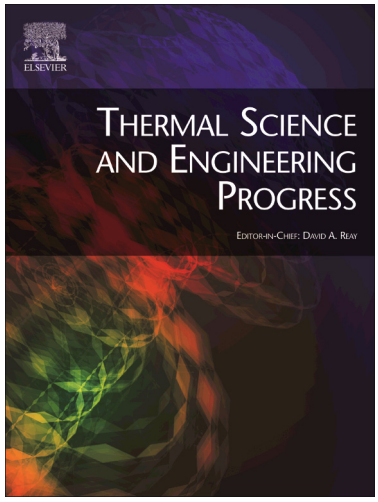

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STABILIZATION OF THE AQUEOUS DISPERSION OF CARBON NANOTUBES USING DIFFERENT APPROACHES

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ABSTRACT

This paper presents experimental investigations on aqueous dispersion of multi-walled carbon nanotubes (MWCNTs). Three experimental approaches are considered to improve MWCNTs dispersion; through functionalization of MWCNTs (1) with surfactants, (2) with oxidative acid treatment and (3) with metal decoration. The first approach investigated the dispersion stability of MWCNTs using different surfactants. In the second approach, surface of MWCNTs is functionalized through nitric acid treatment to facilitate the dispersion of MWCNTs. In the third approach, MWCNTs are decorated with silver nanoparticles and their dispersion behavior is investigated. In the experiments with surfactant addition, the ideal surfactant type and concentration are found as acacia gum at 1 surfactant:MWCNTs weight ratio, which yielded the highest zeta potential value of 26.7 mV. The second approach yielded an improved dispersion stability by visual observation of the fluid over a period of three months with no trace of sedimentation. Visual observation of the fluids prepared using silver-decorated MWCNTs showed a weak dispersion behavior. Thermal conductivity enhancement of the nanofluids at 0.1 wt.% nanoparticle loading are calculated as 5.84% for silver-decorated MWCNT nanofluids, 8.14% for acid-functionalized MWCNT nanofluids and 8.85% for surfactant-functionalized MWCNT nanofluids. Functionalization with surfactant and oxidative acid treatment are found as the two useful methods for the stability and enhanced thermal conductivity of MWCNT dispersions.

Keywords: Nanofluids, multi-walled carbon nanotubes, surface functionalization, dispersion stability, thermal conductivity, metal decoration