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$BN:SiO_2$ Hybrid Nanofluids Based On Ethylene Glycol:Water As Enhanced Thermal Fluids

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Extended Abstract

The link between energy consumption, economic growth and carbon dioxide emissions has been clearly stablished in the literature [1-3]. Thus, improving energy efficiency and heat exchange processes, both industrial and domestic, becomes essential to achieve sustainable economic growth without endangering the environment. In this context, this work presents nanofluids based on ethylene glycol:water with volume ratios of 15:85 and 30:70, which have been improved by the dispersion of boron nitride (BN) and silica oxide (SiO_2) nanoparticles, as enhanced thermal fluids. Mono BN and SiO_2 nanofluids at 0.01 wt% and hybrid $BN:SiO_2$ nanofluids at different concentrations up to 0.1 wt%. Their temporal stability, thermal conductivity, and isobaric heat capacity were experimentally determined. The study of the stability was carried out by observing the evolution of the hydrodynamic size of the nanoparticles within the dispersion. All samples showed good temporal stability under shaken condition, even the most concentrated ones, such as the 0.1 wt% $BN:SiO_2$ hybrid nanofluid (mass ratio 1:9 $BN:SiO_2$), whose hydrodynamic size remained quasi-constant around 292 nm after 21 days. The isobaric heat capacities of base fluids and nanofluids were measured using the quasi-isothermal temperature-modulated differential scanning calorimetry method, in a temperature range from 273 to 323 K. The experimental values of isobaric heat capacity for base fluids are in good agreement with those previously reported in the literature for EG:W 15:85 and 30:70 [4]. The highest values were noticed for the base fluid with lower EG concentration (15:85) and an average decrease of 5.2% was registered with the EG content rise (30:70). In the same way, decreases in isobaric heat capacity were observed for all nanofluids regarding their corresponding base fluids. The influence of the loading of SiO_2, BN and $BN:SiO_2$ nanoadditives on the thermal conductivity was analysed for the temperature range between 283 and 323 K. The thermal conductivity increases with temperature and also with the loading of nanoparticles, reaching an average increase of up to 2.3% for the 0.1 wt% BN/SiO_2 hybrid nanofluid ($BN:SiO_2$ mass ratio of 9:1) regarding the corresponding base fluid, EG:W 15:85.

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