

The effect of nanoparticles composition ratio on dynamic viscosity of Al₂O₃-TiO₂-SiO₂ nanofluid

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ABSTRACT

In recent years, research has concentrated on improving the thermo-physical properties of a single component nanofluid. As a result, hybrid or composite nanofluids are being developed to enhance heat transfer performance. Dynamic viscosity of Al₂O₃-TiO₂-SiO₂ nanoparticles suspended in W/EG mixture (60:40) in various composition ratios were investigated for a constant volume concentration of 3.0%. Experiments were performed for the mixing ratio (CR 1, CR 2, CR 3, CR 4, CR 5, CR 6) of Al₂O₃-TiO₂-SiO₂ nanofluids with temperature conditions of 30, 40, 50, 60 and 70 C. The dynamic viscosity measurements were undertaken at temperatures between 30 and 70 C using Brookfield LVDV-III Ultra Rheometer. The experimental results reveal that the mixing ratio of CR 3 (20:64:16) is considered the best ratio with the lowest relative viscosity when compared to CR 1, CR 2, CR 3, CR 4, CR 5, and CR 6. As a result, the mixing ratio of three distinct nanoparticles namely TiO₂, SiO₂, and Al₂O₃ became the control and performance factors in the present study. When compared to other mixing ratios, the CR 3 is raising the relative viscosity yields the smallest increment of 2.35-3.08 times higher than based fluid. It was recommended to determine the lowest dynamic viscosity of Al₂O₃-TiO₂-SiO₂ nanofluids or tri-hybrid nanofluids for the lowest potential pressure drop in heat transfer applications.

KEYWORDS

Composition ratio; Dynamic viscosity; Ethylene glycol-water; Pressure drop; Tri-hybrid nanofluids

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