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Experimental determination of thermophysical properties of Indonesian fly-ash nanofluid for heat transfer applications

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Abstract

The heat transfer fluid's thermal properties are a significant topic of current research. In this study, coal fly ash nanoparticles of 14 nm average diameter were dispersed in water to prepare stable nanofluid in the concentration range of 0.1–0.5% volume concentration. The nanofluid was stabilized and uniformly dispersed using an ultrasonic homogenizer with the addition of Triton–X 100 surfactant. The thermophysical properties, viz., thermal conductivity, viscosity, density, and specific heat of the nanofluid were measured in the temperature range of 30–60 °C. The maximum thermal conductivity and viscosity augmentation of 14 and 6.38% are observed for 60 and 30 °C, respectively, at 0.5% volume concentration compared to water at the same temperatures. The experiment results revealed that thermal conductivity, viscosity, and density increased while specific heat decreased with an increase in nanofluid concentration. Also, the thermal conductivity and specific heat increase, while viscosity and density decrease with an increase in temperature. The thermal conductivity of fly ash nanofluid is observed to be superior by 3.9% compared to SiO_2 nanofluid which can be due to its chemical constituents. Hence, fly ash particles are useful in heat transfer applications.

Keywords:
Fly ash nano fluids, ball mill, partical size, thermophysical properties, heat transfer**.**
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