Modelling the viscosity of carbon-based nanomaterials dispersed in diesel oil: a machine learning approach

Ismail Adewale Olumegbon, Ibrahim Olanrewaju Alade, Mirza Sahaluddin, Mojeed Opeyemi Oyedeji & Aliyu Umar Sa'ad

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Abstract

The viscosity of a nanofluid is one of its fundamental thermophysical properties, and it is an important consideration in heat transfer applications. Although the viscosity can be reliably obtained from experimental measurements, the development of models to predict the viscosity is a faster and more convenient approach. This study focuses on creating a machine learning model for the viscosity of different carbon nanomaterials dispersed in diesel oil. The nanomaterials considered here include multi-walled carbon nanotubes, graphene nanoplatelets, and their hybrid combinations. A support vector regression-based model was developed and validated using 120 experimental data points in the temperature range 5–100 °C. The model inputs are the nanoparticle mass fraction, the fluid temperature, and the viscosity of the diesel oil. The developed model yields very good predictive performance on the training and testing datasets. The correlation coefficient and the root mean square error were 99.98% and 0.0076 Pa s, respectively, for the training dataset, and 99.99% and 0.0026 Pa s for the testing dataset. These results indicate that the developed model is extremely accurate for predicting the viscosity of carbon-based nanomaterials in a diesel oil medium, and it was found to outclass all existing models. This model could therefore be extremely useful in the design of heat transfer applications.

Keywords: Viscosity ; Nanofluids ; Graphene ; Multi-walled carbon nanotubes ; Diesel oil

Citation

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