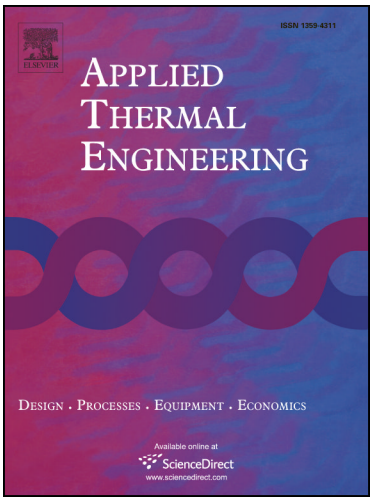

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Experimental evaluation, new correlation proposing and ANN modeling of thermal conductivity of ZnO-DWCNT/EG hybrid nanofluid for internal combustion engines applications

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Abstract

Thermal conductivity of ZnO-DWCNT / EG hybrid nanofluid was investigated experimentally at solid volume fraction of 0.045 to 1.9% and a temperature of 30-50 ° C. ZnO particles mix (with an average diameter of 10-30 nm) and double wall carbon nanotubes (DWCNT) (internal diameter of 3-5 nm and 5-15 nm external diameter) at a ratio of 90%: 10% in ethylene glycol (EG) dispersed and its thermal conductivity was measured. The results showed that maximum relative thermal conductivity (TCR) at 50 temperature and the solid volume fraction of 1.9%, equivalent to 24.9%. Economic evaluation and qualitative performance showed that nanofluids hybrid compared with ZnO and nanofluids containing MWCNT, in terms of increasing thermal conductivity (TCE) and economically, is quite effective. A new correlation to predict TCR in terms of solid volume fraction and the temperature was proposed. This correlation has a coefficient of determination (R-squared) and the maximum error of 0.9826 and 2.9%, respectively. The greatest sensitivity was calculated at a maximum temperature and solid volume fraction. Based on the TCR data the artificial neural network (ANN) was developed. The best case ANN containing two hidden layer and 3 neurons in each layer was obtained. This ANN has an R-squared and MSE and was equal to 0.9966% AARD and 1.3127e-05 and 0.0489,