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Adnan Mohammed Hussein

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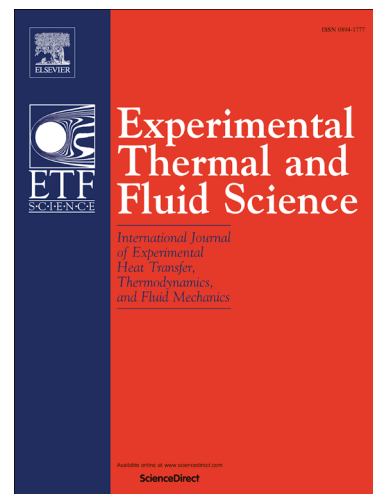
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## Thermal performance and thermal properties of hybrid nanofluid laminar flow in a double pipe heat exchanger

Adnan Mohammed Hussein\*

*Al-Haweeja Institute, Northern Technical University, IRAQ*

*\*E-mail: [adnanphd2012@gmail.com](mailto:adnanphd2012@gmail.com), Phone no.: +9647727770128*

### ABSTRACT

The mixing of solid nanoparticles suspended in liquid is defined as a hybrid nanofluid that represents a new class of heat transfer augmentation. In order to examine the laminar convective heat transfer of nanofluid, experiments were conducted using a hybrid nanofluid through a double pipe heat exchanger. The mixtures of Aluminum Nitride nanoparticles into ethylene glycol (EG) as a basefluid are considered to augment the heat transfer. The hybrid nanofluid is prepared with the volume fraction of 1% to 4% and having the size of diameter 30 nm in addition to measuring the thermal properties experimentally. Both hydrodynamic and thermal performances of AlN nanoparticle dispersed in EG are studied. The flow rates and Reynolds number along experiments are changed in the range of 0.5 to 4 LPM and 500 to 1750 respectively. The results show that the friction factor decreases when there is an increase in the flow rate and it increases when the volume concentration of nanofluid is increased while the Nusselt number increases by increasing of the flow rate and volume concentration of nanofluid. Meanwhile, the application of hybrid nanofluid with low volume fractions may augment heat transfer efficiency up to 160% as compared with conventional fluids. It was found that the thermal performance of hybrid nanofluid could drastically augment the thermal performances of a heat exchanger in comparison with basefluid up to 35% at high volume fraction.

*Keywords:* nanofluid, friction factor, Nusselt number, heat exchanger.

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