Improve the heat exchanger efficiency via examine the Graphene Oxide nanoparticles: a comprehensive study of the preparation and stability, predict the thermal conductivity and rheological properties, convection heat transfer and pressure drop

Published: 22 August 2021

Volume 147, pages 7509–7521, (2022) Cite this article

Ramin Ranjbarzadeh, Alireza Akhgar, Roozbeh Taherialekouhi, Annunziata D'Orazio, S. Mohammad Sajadi, Ferial Ghaemi & Dumitru Baleanu

Abstract

In this research, the effect of using GO/ water nanofluid as a coolant fluid in an isothermal heat transfer system was studied. At first, to evaluate the atomic bond, chemical, and surface structure of the nanoparticles, XRD–FTIR and FESEM tests were used. Two-step method was used to prepared nanofluid then DLS test was utilized to examine the stability of the nanofluid. Thermal conductivity and the dynamic viscosity were measured experimentally from 25 to 75 ℃ and volume fractions of 0–0.15%. The maximum improvement in thermal conductivity is 11.2% at 0.15% and 75 ℃. Also The dynamic viscosity increased. The validity and uncertainty of the test results were examined. The heat transfer and turbulent flow of the nanofluid under a constant temperature boundary condition were investigated between 6000 and 18,700 Reynolds numbers. Various parameters such as the pressure drop, friction factor, convection heat transfer coefficient, and Nusselt number of the turbulent flow were evaluated. According to the results, the greatest increase in the convection heat transfer coefficient of the nanofluid was 34.7% compared to that of the base fluid. Also, the greatest enhancement in the friction factor was 9.64%. It can be stated that the improvement of the convection heat transfer coefficient dominantly affects the pressure drop so this nanofluid can be used as a coolant fluid in industrial systems.