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Chamkha, A., Ismael, M., Kasaeipoor, A., Armaghani, T.

Entropy generation and natural convection of CuO-water nanofluid in C-shaped cavity under magnetic field
(2016) *Entropy*, 18 (2), art. no. 50, . Cited 46 times.

Abstract
This paper investigates the entropy generation and natural convection inside a C-shaped cavity filled with CuO-water nanofluid and subjected to a uniform magnetic field. The Brownian motion effect is considered in predicting the nanofluid properties. The governing equations are solved using the finite volume method with the SIMPLE (Semi-Implicit Method for Pressure Linked Equations) algorithm. The studied parameters are the Rayleigh number (1000 ≤ Ra ≤ 15,000), Hartman number (0 ≤ Ha ≤ 45), nanofluid volume fraction (0 ≤ φ ≤ 0.06), and the cavity aspect ratio (0.1 ≤ AR ≤ 0.7). The results have shown that the nanoparticles volume fraction enhances the natural convection but undesirably increases the entropy generation rate. It is also found that the applied magnetic field can suppress both the natural convection and the entropy generation rate, where for Ra = 1000 and φ = 0.04, the percentage reductions in total entropy generation decreases from 96.27% to 48.17% for Ha = 45 compared to zero magnetic field when the aspect ratio is increased from 0.1 to 0.7. The results of performance criterion have shown that the nanoparticles addition can be useful if a compromised magnetic field value represented by a Hartman number of 30 is applied. © 2016 by the authors.

2-s2.0-84960391061
Document Type: Article
Publication Stage: Final
Source: Scopus
Access Type: Open Access