Natural Convection of a Nanofluid in Inclined, Partially Open Cavities: Thermal Effects Read More: http://arc.aiaa.org/doi/abs/10.2514/1.T4408

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Abstract:

This paper discusses the phenomenon of natural convection flow in an inclined, partially open enclosure filled with Al2O3–water nanofluid. In the cavity, the horizontal walls and the closed portions of the right wall are thermally insulated. Three thermal cases were considered for the left wall; in the first case, the left wall was considered to be uniformly heated; in the second case, a heat source was attached to the left wall; and in the third, the left wall had a heat sink. For case 2, there is a heat source attached to the left wall. For case 3, the left wall contains a heat sink. The partial differential equations governing the problem were solved numerically using the finite difference method. The obtained results were presented by the local Nusselt number, the average Nusselt number, streamlines, and isotherms with various pertinent parameters, namely, the Rayleigh number (103≤Ra≤106), the solid volume fraction (0≤ϕ≤0.2), different lengths of the heat source/sink (0.2≤BL≤1), different locations of the heat source/sink (0.2≤bL≤0.8), different lengths of the aperture (0.2≤BR≤1.0), different locations of the aperture (0.2≤bR≤0.8), and an inclination angle (0 deg≤γ≤60 deg). It is found that, for all cases, the fluid features were strongly affected by changing the aperture length or the aperture location. Also, a clear increase in the mean Nusselt number could be obtained by increasing the Rayleigh number.Moreover, an enhancement in the average Nusselt number was found by increasing the nanoparticle volume fraction. A good natural convection could be obtained by increasing the heat source/sink length. Title the cavity by 60 deg leads to increase the absolute values of the stream function and a decrease in the maximum values of the maximum temperature. The best location of the heat source was found to be at the top of the left wall, whereas the best position of the aperture was found to be at the top of the right wall. Read More: http://arc.aiaa.org/doi/abs/10.2514/1.T4408

Published In:

J. of thermophysics and heat transfer , Vol. 29, No. 1 (2015), , pp. 150-165.