Investigation of the Different Shapes Effects of Nanoparticles on the Nanofluids Heat Transfer in Horizontal Annuli

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Abstract

This paper is concerned with the effects of the nanoparticles geometry on the forced convection heat transfer of a nanofluid flow, inside a horizontal annulus uniformly heated at the outer wall while the inner wall is insulated. Four different shapes of $Al2O3$ and $TiO2$nanoparticles, in the pure water base fluid have been investigated with a volume fraction domain between 0 and 6%, and a Reynolds number

equal to 800. Also, all the nanofluids properties are assumed constant. The governing equations with physical boundary conditions have been solved numerically using finite volume approach with the SIMPLER algorithms. The results obtained shows that increasing of the volume fraction increases the bulk and the wall temperatures and increases the Nusselt number. For the fixed volume fraction, the bulk temperature, the wall temperature and the Nusselt number of the ($Al2O3$ /water) nanofluid is greater than the ($TiO2$ / water) nanofluid. It is clear that elongated shape of nanoparticles like cylinder and platelet have minimum temperature because of the greater viscosity and thermal conductivity whereas blade has the highest temperature due to least viscosity and thermal conductivity. However, the brick shape is lowest in temperature range, although it has low viscosity.

Keywords: Nanofluid, annular duct, forced convection, numerical simulation