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Numerical Investigation of Al2O3/Water Nanofluid Heat Transfer in a Microtube with Viscous Dissipation Effect

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Abstract : In this paper, nanofluid conjugate heat transfer through a microtube with viscous dissipation effect is investigated numerically. The fluid flow is considered as a laminar regime. A constant heat flux is applied on the microtube outer wall and the two ends of its wall are considered adiabatic. Conjugate heat transfer problem is solved and investigated for this geometry. It is shown that viscous dissipation effect which is induced by shear stresses can not be neglected in microtubes. Viscous heating behaves as an energy source in the fluid and affects the temperature distribution. The effect of Reynolds number, particle volume fraction and the nanoparticles diameter on the energy source are investigated and an attempt on establishing suitable equations for assessing the value of the energy source based on Re, Dp and Φ is performed and they are depicted as 3D diagrams. Finally, the significance of viscous dissipation and the influence of these parameters on convective heat transfer coefficient are studied.

Keywords : convective heat transfer coefficient, heat transfer, microtube, nanofluid, viscous dissipation
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