Performance Analysis of Nanorefrigerants In Heated and Rotating Concentric and Eccentric Annulus Cylinders

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ABSTRACT
The past decade has seen rapid development of nanofluids science in many aspects. In recent years, refrigerant-based nanofluids have been introduced as nanorefrigerants due to their significant effects over heat transfer performance. In this investigation, the Control Volume based Finite Element Method (CVFEM) is used to simulate the natural convection heat transfer of nanorefrigerant in cylindrical horizontal annuli with imposed temperatures in both surfaces. The Maxwell–Garnetts (MG) and Brinkman models are also employed to estimate the effect of thermal conductivity and viscosity of nanorefrigerant. The governing parameters are nanoparticles types, nanoparticles concentration and size, effect of Rayleigh numbers (Ra), eccentricity and rotation of inner cylinder. Results are presented in the form of isotherms and streamlines of nanorefrigerant temperature and velocity. The results indicate that Al_2O_3/R141b with concentration (2%) and nanoparticles size (20 nm) has the best heat transfer performances. Moreover, the heat transfer and fluid flow enhance by increasing the Rayleigh numbers (Ra). Eccentricity and rotation of inner cylinder also have effects on heat transfer characteristics.

KEYWORDS: Natural convection, heat transfer, nanorefrigerant, annulus

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