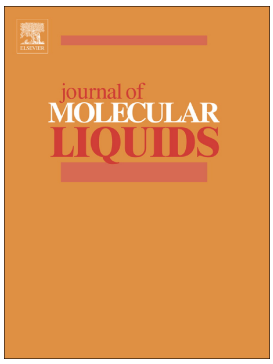

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Investigating heat transfer and entropy generation for mixed convection of CuO–water nanofluid in an inclined annulus

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Abstract

Mixed convection of the CuO–water nanofluid inside an inclined annulus is investigated based on the first and second laws of thermodynamics. The Boussinesq approximation is employed, and all properties (except the density) are considered to be constant. The same heat fluxes are employed on both walls of the annulus. The effects of Richardson number, volume fraction and inclination angle on the second law characteristics and heat transfer are evaluated. The Bejan number and entropy generation rates are calculated to investigate the irreversibility types due to friction and heat transfer. At greater Richardson numbers, the velocity profile becomes flatter owing to easy formation of the natural convection. The results show that increase of the inclination angle from 0° to 75° leads to increase of convective heat transfer and decrease of total entropy generation and consequently, a proper heat exchange together with a low irreversibility are achieved. Additionally, with increment of Richardson number, both total entropy generation and convective heat transfer increase. Meanwhile, frictional entropy generation decreases while thermal entropy