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Three-dimensional combined radiation-magnetoconvection of low electrically conductive dielectric oxide melt
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Abstract
Purpose: The purpose of this paper is to investigate the coupled effect of magnetic field and radiation on convective heat transfer of low electrically conductive dielectric oxide melt. Design/methodology/approach: The 3D Navier–Stokes equations are formulated using the vector potential-vorticity formulation and solved using the finite volume method (FVM). The radiative heat transfer equation is discretized using the FTnFVM method. A code was written using FORTRAN language. Findings: The obtained numerical results are focused on the effect of the different parameters on the heat transfer and the flow structure with a special interest on the 3D transvers flow. It is found that the flow is developing in inner spirals and the magnetic field intensifies this 3D character. The radiation acts mainly at the core of the enclosure and causes the apparition of the merging phenomenon near the front and back walls. Originality/value: The effect of magnetic field on convective heat transfer of highly electrically conductive fluids has been intensively studied. Reciprocally, the case of a fluid with low electrical conductivity is not so much investigated, especially when it is coupled with the effect of radiation. These two effects are studied in this paper for the case of a low-conductive LiNbO3 oxide melt. © 2018, Emerald Publishing Limited.

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