MHD/EHD Gravity Flow of Molten Glass through Inclined Rectangular Duct with Temperature-Dependent Properties

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Laminar gravity flow of a highly viscous molten glass is studied in a non-isothermal inclined rectangular duct assuming that the fluid is transferring significant heat to the surroundings. It is assumed that the fluid is subject to an external electrical field in order to control its rate of cooling. An external magnetic field will also be applied simultaneously in order to enhance the flow rate through the rise of the Lorentz force. The analysis involves fluid physical properties to be temperature-dependent. The coupled set of momentum and energy equations is simplified using the creeping flow approximation. A one-dimensional approach will also be used to further simplify the analysis. The governing equations so obtained will be solved numerically using DVODE scheme. Numerical results are presented for average velocity and temperature variation along the duct for different values of the wall heat loss, heat diffusion, electric field intensity, and magnetic field intensity. The results suggest that, depending on the physical properties of the melt, bifurcation may occur over a range of Lorentz parameter. That is, the solutions to the momentum and energy equations are found to be multi-valued for certain combination of parameters. This nonlinear behavior is shown to have resulted from the interaction which exists between the velocity and temperature fields on the one hand and the temperature-dependent material properties on the other hand. Compared with circular ducts, for a given cross-sectional area, rectangular ducts deliver less flow but they provide us with a better control on the temperature variation along the duct.

این صفحه به محتوا تاییدیه نمایه سازی مقاله در یاگه استنادی سپریشکا می‌باشد. در هر لحظه به منظور تایید اتصال این گواهی می‌توانید وضعیت ثبت مقاله را از طریق لینک فوق به صورت آنلاین کنترل نمایید.