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HEAT TRANSFER BEHAVIOURS OF PARALLEL SQUARED CHANNEL SYSTEMS IN HIGH TEMPERATURE THERMAL STORAGE

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ABSTRACT In this paper a numerical analysis on high temperature thermal storage in a honeycomb solid matrix is accomplished considering two models in transient regime. The two models are related to a multiple channels system (direct model) and a porous medium model. Both the models are analyzed for different number of channels or pores per unit of length (PPU). The multiple channels system is modeled by coupling continuity, momentum and energy equations for fluid and energy equation for solid matrix whereas for porous medium the LTNE is assumed and continuity, Brinkman-Forchheimer-extended Darcy model and energy equations for fluid phase and energy equation for solid phase are considered. The fluid dynamic and thermal characteristics are evaluated in terms of PPU considering the honeycomb system as an anisotropic porous medium. The governing equations for both models are solved numerically by Ansys-Fluent code assuming that the thermal storage system is adiabatic. Results in terms of temperature profiles, solid temperature rise and heat transfer rate are given and it is found that the two models are in good agreement and the honeycomb system can be modeled by a porous medium model allowing the numerical simulation also for honeycomb with high PPU. It is found that the charging time decreases for high PPU. For assigned partial charging time the increase in PPU determines an increase in thermal energy stored.