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ABSTRACT

Simulation of Phase-Change Heat Transfer based on an Implicit/Explicit Numerical Formulationd

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The This article introduces a novel numerical approach for addressing phase change in the energy equation, extending the One-Energy Equation Model (1EEM) to handle both melting and solidification for pure substances and alloys. Before melting and after solidification, the solid is modeled as a porous medium with low porosity and minimal permeability. During phase transition, thermal equilibrium is assumed in the mushy zone. As the temperature rises beyond the melting point, the viscous and form drags in the momentum equation decrease. The latent heat is split between implicit and explicit methods in the energy equation, improving numerical stability. After solving the temperature field, the liquid fraction is updated throughout the domain. The algebraic systems are solved using the SIMPLE algorithm, with inner iterations relying on the Strong Implicit Procedure. Initial results indicate that the model provides results consistent with existing literature for pure substances. This new formulation aims to improve the stability of phase-change models based on porous media.