

# Numerical modeling of a phase change material in a rectangular cavity : role of natural convection to the energy balance

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Convective flows with phase change material (PCM) is observed not only in nature e.g. melting of sea ice or basal melting [1] but also in built environment [2], technical applications [3] or thermal storage systems [4] when such equipment features a PCM layer. The case of a vertical cavity is both of interest for energy storage and geophysics [4,5].

In the present work we take into account the temperature dependence of the physical properties of heptadecane, a widely used PCM in experimental investigations. In particular we have measured the heat of fusion by means of differentially scanning calorimetry. Finite thickness effects are taken into account by investigating numerically both the liquid domain and the solid domain.

We perform the study in COMSOL Multiphysics with the effective heat capacity method, where a modified heat capacity over the melting temperature range of the PCM is defined, blending heat capacity and latent heat of fusion. A 2d vertical geometry in agreement with the experimental setup is chosen. Nusselt numbers at boundaries and flow patterns are reported. Thermal imbalance is compared to solidification front displacement. A Kelvin-Helmholtz like instability is observed, with weak velocity according to the dispersion relation.

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## Références

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