Unsteady simplified numerical model for the prediction of latent heat thermal energy storage devices

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The thermal energy storage together with other energy storage systems represents a fundamental part of energy transition to net zero carbon energy production systems. In thermal solar or waste heat recovery systems the efficiency in storing thermal energy could represent an interesting technology to explore. Due to their high energy density, phase change materials can be used to maximize the energy density of such a system. However, the phase change, usually solid to liquid or vice versa, induces convective heat transfer that depends on liquid PCM motion together with phase change interface prediction. In the present contribution a simplified unsteady numerical model for the prediction of the performance of a latent heat thermal energy storage device will be presented. The model is based on the physical behaviour of the phase change material during the charging and discharging process described in several international journal papers. Due to its modularity the model can be used in cascade systems of homogeneous and heterogeneous devices. The validation study confirms the reliability of the model in both phases. The model can manage the sensible part of the process extending the application to real cases.

Acknowledgments

This research was funded by the Italian Ministry of Environment and Energy Security through the Research on Electric System—PTR 2022- 24—Objective: Technologies—Project 1.2/WP4 (Thermal Storage: materials and innovative systems).