

SUMMARY

This PhD Thesis has been developed at the Instituto de Ingeniería Energética of the Universitat Politècnica de València, within the group SIMES dedicated to the research on thermal systems.

The group SIMES has developed a research project on latent heat storage of thermal energy in which different materials have been studied in order to analyse their performance as phase change materials for the latent heat storage.

The aim of this thesis is the development of two models in MATLAB for the simulation of the performance of latent heat thermal energy storage systems in their processes of charge and discharge, in particular for cold storage. The development of these models allows for a deep understanding of the mechanisms that are governing the performance of this systems.

The need of two different models is due to the different physical nature of the studied phase change materials: water and paraffin RT8. Each material determines a different performance in the phase change process. While water presents two differentiated phases and separated by an interphase, the paraffin RT8 experiences the solid-liquid phase change in a temperature interval, within a mushy state which is not completely liquid nor solid.

Consequently, it was necessary to develop of a moving-boundary model for the simulation of the tanks with ice-water, and another enthalpy model for the simulation of tanks with paraffin RT8 as PCM.

Finally, the developed models have helped analyse the performance of both materials in different latent heat storage applications, and determine the suitable system for each case. The models are useful also as a tool for the design and sizing of the system, to study their operation and carry out techno-economical analysis of different configurations.