Inverse Problem and a New Device to Estimate Thermal Conductivity of Composite Phase Change Material

M. Karkri[1], A. Nachaoui[2]

[1]Université Paris-Est, CERTES, Créteil Cedex, France
[2]Département de Mathématiques 2, Nantes Cedex, France

Abstract

A new experimental device has been developed in order to characterize the phase change material (PCM) thermal properties (thermal conductivity k, sensible and latent heat thermal energy storage, cp and Lf) in the solid phase, during the solid-liquid transition and in the liquid phase. It allows to measure cylindrical samples of maximum 60 mm radius and 10 mm thick. A typical measurement consists in imposing a vertical temperature gradient through the PCM sample driven by a heat source, monitoring during the experiment time all the boundary conditions (temperatures and heat fluxes) and measuring temperature evolution in three locations within the PCM sample. In this work, we will focus only on the solid thermal conductivity characterization. These experiment data are used to solve the inverse heat conduction problem by applying the conjugate gradient method and finally, to determine the PCM thermal properties. Two types of composite PCM have been thermally characterized: paraffin mixed with synthetic graphite (Timrex SFG75) and paraffin mixed with graphite waste.