APPLICATION**NOTE**

PCM – Phase Change Materials From the Solid into the Melt Investigation of Thermal Conductivity by Means of the LFA 467 *HyperFlash*® and DSC 204 ***F1*** *Phoenix*®

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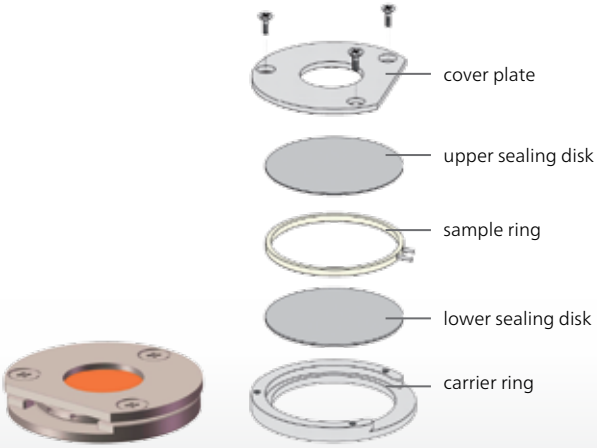
Introduction

PCM (Phase Change Materials) are materials which are used as latent-heat storage systems. The solid-to-liquid phase transition enthalpy is thereby used for heat storage. The application field for latent-heat storage systems spans from pocket heaters to functional textiles to wall and ceiling elements in building construction.

The thermophysical properties of a PCM sample of plant extracts were investigated with the help of the LFA 467 *HyperFlash*® and DSC 204 ***F1*** *Phoenix*®.



1 PEEK sample holder (left) with schematic of the set-up (right)

Test Conditions

LFA:

- 30°C to 150°C solid sample in the standard sample holder (heating)
- 220°C to 30°C liquid sample in the PEEK sample holder (cooling), see figure 1

DSC:

- -10°C to 225°C heating and cooling

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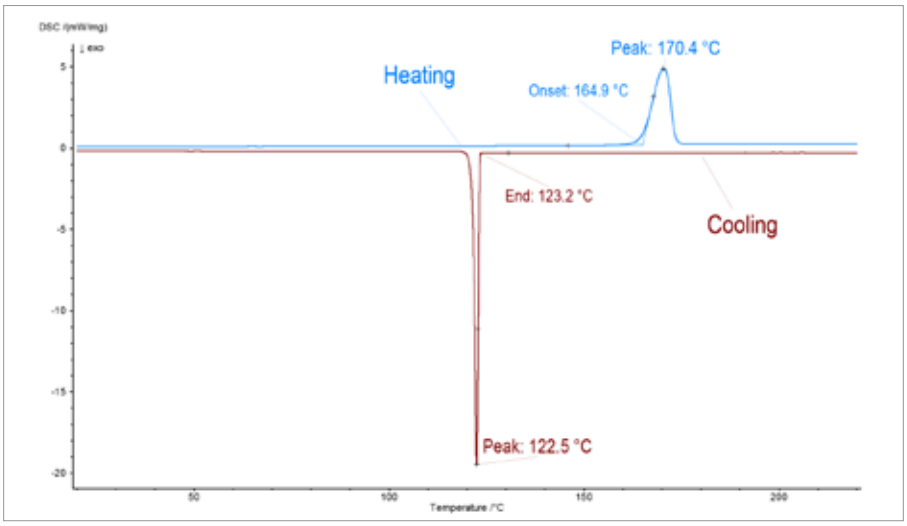
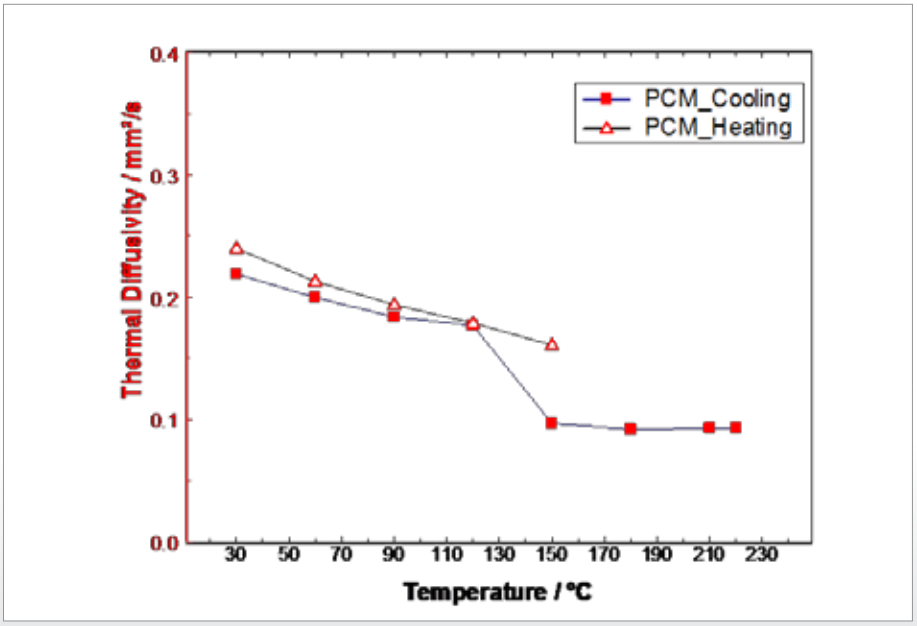


2 DSC signal of the PCM sample during heating and cooling with melting and crystallization peaks

Measurement Results

Figure 2 shows the heating and cooling of the PCM sample by means of DSC. Melting of the sample starts at approx. 165°C (onset), crystallization during cooling, however, only starts again at approx. 123°C. This effect can also be seen for the LFA measurements. The red squares in figure 3 represent the thermal diffusivity of the PCM sample during cooling (from liquid to solid). The step in the the thermal diffusivity can be related to the phase transition. Since the measuring points were recorded during cooling, the phase transiton appears between 120°C and 150°C. The red triangles in figure 3 represent the thermal diffusivity during heating of the PCM sample. Both measurements are in good agreement with one another. Only at 150°C can a significant difference be seen, which is attributable to the different states of the samples (liqud and solid) resulting from the differing melting and crystallization temperatures.



3 Thermal diffusivity of the PCM sample during heating and cooling

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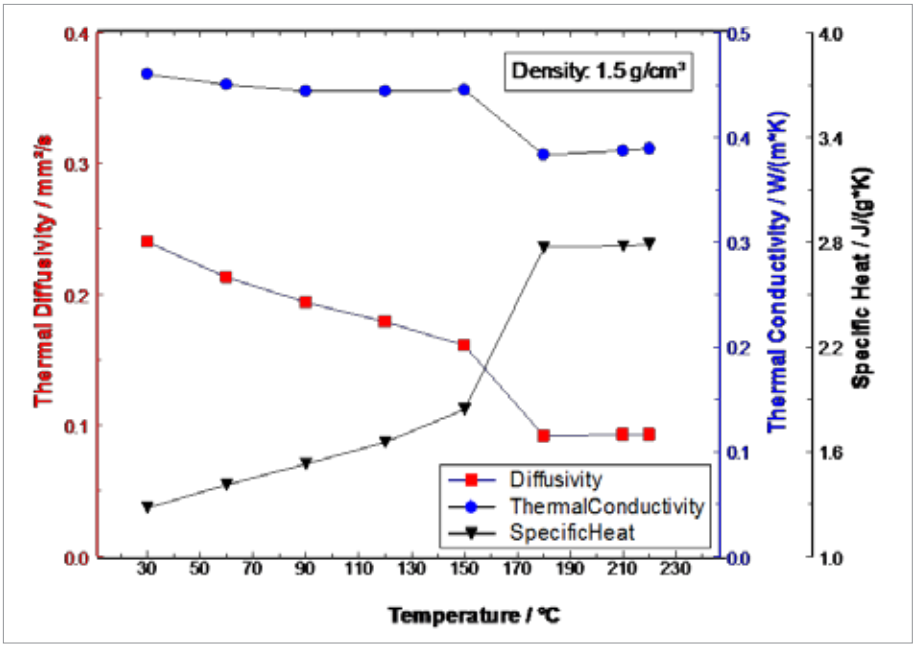

4 Thermophysical properties during heating of the PCM sample

Figure 4 shows the thermophysical properties duirng heating of the PCM sample between 30°C and 220°C as a combination of the two measurements. The solid-to-liquid phase transition can be clearly identified in the thermal diffusivity as well as in the specific heat capacity and the thermal conductivity by means of a step between 150°C and 180°C.

Summary

The special sample holder for liquids and pastes (PEEK sample holder) allows investigation of the thermal diffusivity of PCM samples even into the melt, by means of LFA. Comparative measurements with and without the liquid sample holder in the solid range are in good agreement as long as there is good contact between the sample and sample holder (3-layer analysis). DSC measurements allow conclusions to be drawn on the melting and crystallization behavior of the samples and yield data on the specific heat capacity. From the measurements of both methods, reliable statements about the thermal conductivity of the PCM sample in the solid and liquid range can subsequently be made.

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