

Remarks on supercooling, hysteresis and other properties of the SP products

Supercooling:

Supercooling is the decrease in temperature under the material's solidification point without having started the process of solidification. Upon crystallization, heat is produced and the still molten material solidifies. These solidification temperatures are indicated for all Rubitherm materials.

The degree of supercooling is given as the temperature difference between the minimum temperature of the cooling curve and the solidification point that lies above the former. Supercooling is mostly observed for the inorganic PCM materials (SP products).

In practise:

The degree of supercooling for the materials that have been produced and offered by Rubitherm lies in the range between 0,5 and 3 K. This depends on the PCM and the underlying working conditions. In general, smaller quantities reveal a smaller degree of supercooling.

Maximally expected supercooling degree of Rubitherm materials (>150 ml):

PCM	SP-50	SP-30	SP-28	SP-24	SP-21	SP-17	SP-11	SP-11UK	SP-7_2	SP5	SP15	SP21EK	SP24E
Supercooling degree [K]	2	2	2	4	2	2	2	5	2	1,5	1,5	1,5	1,5
PCM	SP25E2	SP26E	SP29Eu	SP31	SP50	SP58	SP70	SP90					
Supercooling degree [K]	1,5	1,5	1,5	2	2	3	3	3					

Example: Supercooling and hysteresis of SP21EK

The function of temperature against time is highlighted in pink and represents the temperature of the PCM for which an enthalpy measurement can be derived.

UK: 0,8K (20,0 bis 20,8°C)

Hysterese: 1,2K (20,8 bis 22°C)

Hysteresis is the temperature difference between the melting and solidification temperature of respective melting and solidification curve.

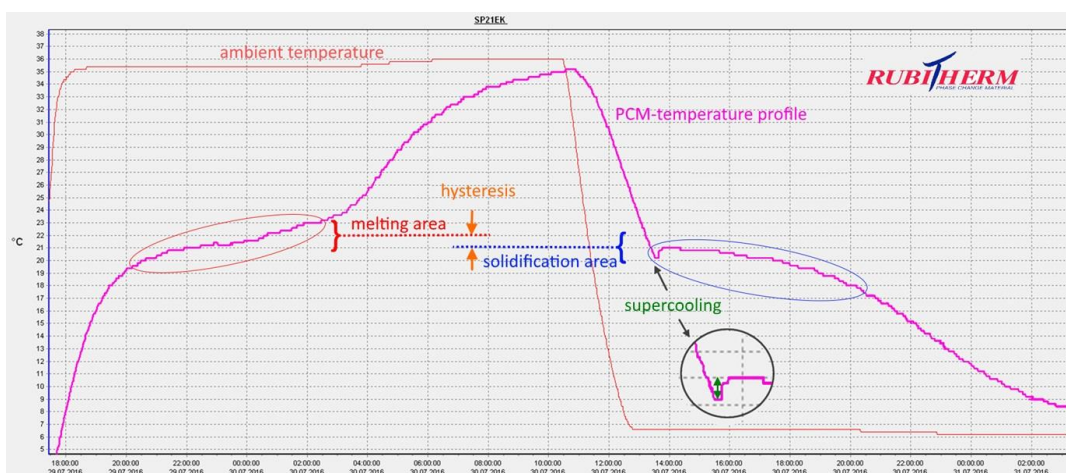


Illustration 1: temporal temperature profile, including supercooling and hysteresis

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Second illustration of hysteresis:

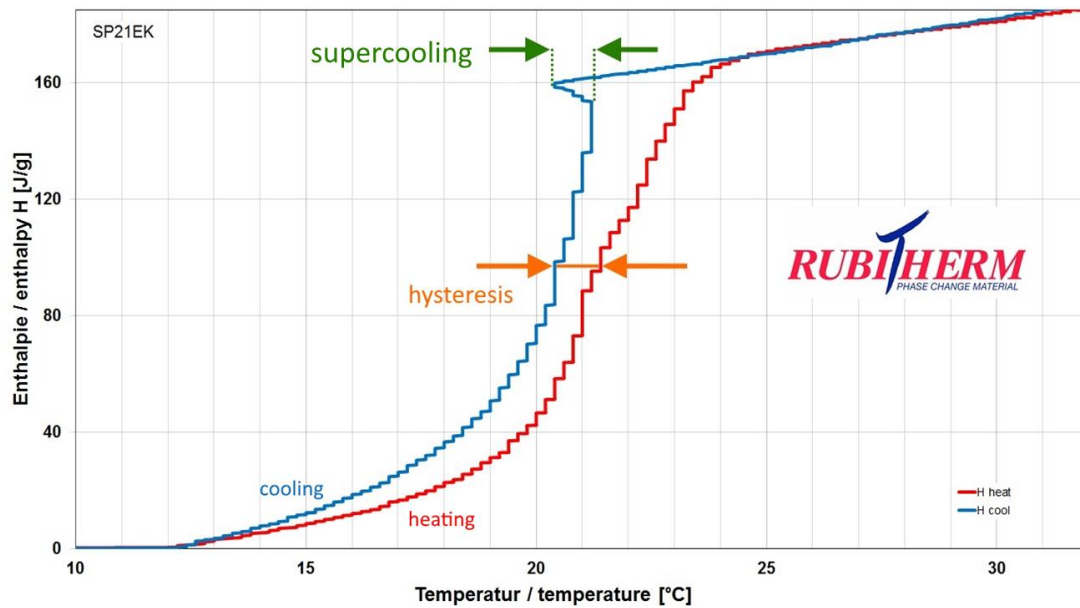


Illustration 2: enthalpy flow depending on temperature, including supercooling and hysteresis

Further remarks for SP

Initialisation:

Initialisation is done usually only prior to the material’s first use: the PCM is cooled much under its melting/solidification temperature. For the SP products with a melting point between 5 and 35 °C initialisation and a tempering at maximally 0 °C is necessary in order the PCM to be fully solidified. For the SP products with higher than 35 °C and lower than 0 °C this treatment is not required.

Water content:

Water is included in all SP materials and its concentration influences the material’s thermal behaviour. For containers that are filled with SP materials, water may evaporate from the material or even be absorbed by the material from the outside. It is thus important not to leave containers uncovered.

Melting:

The SP products have to be used at a maximum temperature (working temperature) of 60 °C. A proper use is guaranteed if the full content of the material is molten prior to use and stirred homogeneously. The PCM may lose its thermal properties by thermal treatment at temperatures much higher than its working temperature. Initialisation reactivates their thermal properties in most cases.

Operating conditions:

We recommend to avoid contact with metals, a direct contact with different metals or alloys must be reliably prevented (galvanic cell)! Air exchange also has to be suppressed. All technical specifications are determined on air-tight sealed SP-samples.

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