

# Accepted Manuscript

Title: Reduction of supercooling in paraffin phase change slurry by polyvinyl alcohol

Author: Georg Hagelstein, Stefan Gschwander

PII: S0140-7007(17)30338-9

DOI: <http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.08.016>

Reference: IJIR 3734

To appear in: *International Journal of Refrigeration*

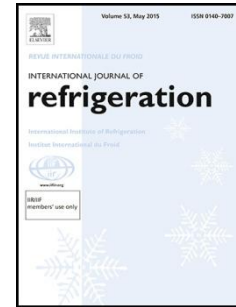
Received date: 20-4-2017

Revised date: 23-8-2017

Accepted date: 24-8-2017

Please cite this article as: Georg Hagelstein, Stefan Gschwander, Reduction of supercooling in paraffin phase change slurry by polyvinyl alcohol, *International Journal of Refrigeration* (2017), <http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.08.016>.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



# Reduction of Supercooling in Paraffin Phase Change Slurry by Polyvinyl Alcohol

Georg Hagelstein<sup>1</sup>, Stefan Gschwander<sup>1</sup>

<sup>1</sup>Fraunhofer Institute for Solar Energy Systems, 79110 Freiburg, Germany

\*Corresponding email: [georg.hagelstein@ise.fraunhofer.de](mailto:georg.hagelstein@ise.fraunhofer.de)

\*Corresponding phone: +49 761 4588-2097

\*Corresponding fax: +49 761 4588-9000

*Keywords: supercooling, phase change slurry, polyvinyl alcohol, paraffin*

## Highlights

- Influence of different surfactants on supercooling in PCM slurries is investigated
- Using polyvinyl alcohol as surfactant reduces supercooling from 12 K down to 2 K
- Effect of polyvinyl alcohol on supercooling depends on degree of hydrolyses
- Nucleation mechanism on polyvinyl alcohol surface structure is proposed

## ABSTRACT

Dispersed phase change materials (PCM) tend to supercool due to absence of nucleation promoting surfaces. Surfactants stabilising phase change slurries (PCS) offer a useful surface to catalysing nucleation at the particle interface. Temperature dependent X-ray diffraction (XRD) and differential scanning calorimetry (DSC) analysis were used to investigate the crystallisation of *n*-octadecane-water-slurries stabilized by common used surfactants (Triton X100, Tween60 and Span60) as well as by several polyvinyl alcohols (PVA) differing in degree of hydrolyses and polymerisation. With PVA supercooling of these phase change slurries is reduced from 12 K down to 2 K independent of the particle size, whereas other surfactants reduce supercooling by 2 K. The results are discussed by taking into account nucleation acceleration through PVA crystals which are partially formed at the paraffin-water interface. The results show that PVA combines the two functionalities to act as surfactant and as nucleating agents in paraffin slurries.

## NOMENCLATURE

Abbreviations		Parameters	
a.u.	arbitrary units	<i>a</i>	unit cell dimension (Å)
DSC	differential scanning calorimetry	<i>α</i>	angle of unit cell (°)
NMR	nuclear magnetic resonance	<i>b</i>	unit cell dimension (Å)
O	stable orthorhombic phase	<i>β</i>	angle of unit cell (°)
PCM	phase change material	<i>c</i>	unit cell dimension (Å)
PCS	phase change slurry	<i>DH</i>	degree of hydrolysis (%)
PVA	polyvinyl alcohol	<i>d<sub>V50</sub></i>	median for particle size distribution based on volume (μm)

Download English Version:

<https://daneshyari.com/en/article/5016937>

Download Persian Version:

<https://daneshyari.com/article/5016937>

[Daneshyari.com](https://daneshyari.com)