Sol-Gel Microencapsulation Of $NaNO_3$ As Phase Change Material For Thermal Energy Storage

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Abstract

$NaNO_3$ has been selected as Phase Change Material (PCM) due to its convenient melting and crystallization temperatures for Thermal Energy Storage (TES) in solar plants or recovering of waste heat in industrial processes [1,2]. However, incorporation of $NaNO_3$ requires its protection (i.e. encapsulation) into containers or support materials to avoid incompatibility or chemical reaction with the media where incorporated (i.e. corrosion in metal storage tanks). As a novelty, in this study, sol-gel microencapsulation of the inorganic salt has been carried out using also an inorganic compound (SiO_2) instead of the conventional polymeric shells used for organic microencapsulations and not suitable for high temperature applications (i.e. 300-500 °C) [3-4]. Feasibility of the synthetized microparticles has been demonstrated by different experimental techniques in terms of thermal energy storage capacity and thermal stability and durability through thermal cycles. The effectiveness of microencapsulated $NaNO_3$ as thermal energy storage material depends on the core:shell ratio used for the synthesis and on the maximum temperature supported by $NaNO_3$ during use.

References

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Figures

a) b)

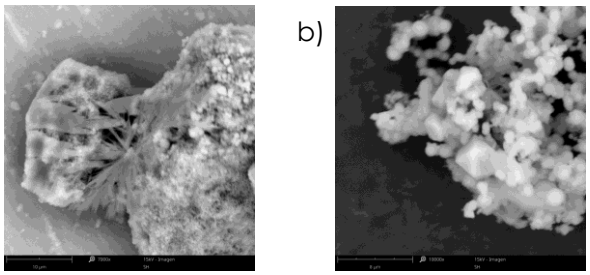

Figure 1: Micrograph by Scanning Electron Microscopy (SEM) of $NaNO_3$-SiO_2 microparticles with different core:shell ratio

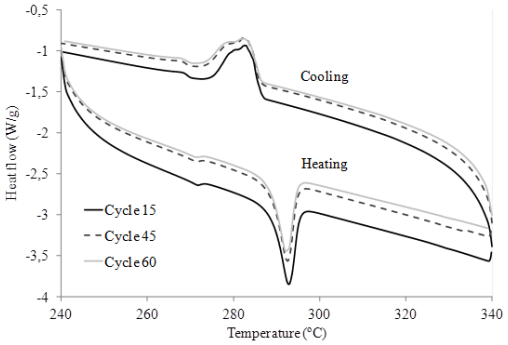

Figure 2: Thermograms by Differential Scanning Calorimetry (DSC) of $NaNO_3$-SiO_2 microparticles after thermal cycles

Acknowledgements

The research leading to these results are based on the financial support from NASR, ENERHIGH project, under the Competitive Operational Programme 2014-2020. Contract 93/09.09.2016 and the EC financial support under the H2020 TWINN 692216 SUPERMAT project.