Short Communication Journal of Lasers, Optics & Photonics 2020
Vol.7 No.7

Applied Physics 2019: A promising biosourced, organic phase change material for seasonal storage - Marie Duquesn - Bordeaux INP

Marie Duquesne
Bordeaux INP, France

BioMCP aims to study bio sourced phase change materials for the thermal energy storage in buildings and heating networks. Thermal energy storage is one of the key elements to optimize the use of available energy resources (especially renewable ones) and to improve the energy efficiency of buildings. Phase change materials (PCMs) used for the thermal energy storage are an important class of materials which substantially contribute to the efficient use and conservation of waste heat and solar energy.

In this framework, our objective is to develop and study new bio sourced phase change materials, able to compete with water as storage material and presenting improved performances in comparison with currently used PCM (ie: low cost, high energy density, low ecological impact). Among bio-based materials, Xylitol has a high potential as a thermal energy material. Its melting point is inferior to 95C which allows combining the storage unit containing Xylitol with cheap solar collectors. Its latent heat is superior to 263 J.g-1 and its total energy density is 4-5 times higher than the one of water (110-150 kWh.m-3 whereas it is approximately 30 kWh.m-3 for water on a seasonal basis). Its high and stable undercooling allows long-term storage in a metastable state with reduced thermal losses and a negligible risk of spontaneous discharge.

However, the activation of the energy discharge process (crystallization activation) is difficult and the subsequent crystallization rates (discharge powers) are very low. Our work in the framework of the FP7 EU SAM.SSA Project, coordinated by Elena Palomo Del Barrio, aims at finding out an easy to implement and efficient solution to discharge the storage unit at the required power when needed. This means being able to trigger nucleation at any time (or temperature) followed by a crystallization of the entire phase change material in due time. Different techniques to crystallize Xylitol have hence been considered. Finally, the feasibility of an innovative, efficient and low intrusive technique to activate the energy discharge is proven. Bubble agitation is a very promising technique. Our work focuses on providing a better understanding of the influence of bubbling on crystallization, on identifying key related variables and on paving the way for bubbling conditions optimization. BioMCP aims to review bio sourced phase transition materials for the thermal energy storage in buildings and heating networks.

Thermal energy storage is one among the key elements to optimize the utilization of obtainable energy resources (especially renewable ones) and to enhance the energy efficiency of buildings phase transition materials (PCMs) used for the thermal energy storage are a crucial class of materials which substantially contribute to the efficient use and conservation of waste heat and solar power . during this framework, our objective is to develop and study new bio sourced phase transition materials, ready to compete with water as storage material and presenting improved performances as compared with currently used PCM (ie: low cost, high energy density, low ecological impact). Among bio-based materials, Xylitol features a high potential as a thermal energy material. Its freezing point is inferior to 95C which allows combining the storage unit containing Xylitol with cheap solar collectors. Its heat of transformation is superior to 263 J.g-1 and its total energy density is 4-5 times above the one among water (110-150 kWh.m-3 whereas it's approximately 30 kWh.m-3 for water on a seasonal basis).

Its high and stable undercooling allows long-term storage during a metastable state with reduced thermal losses and a negligible risk of spontaneous discharge. However, the activation of the energy discharge process (crystallization activation) is difficult and therefore the subsequent crystallization rates (discharge powers) are very low. Our add the framework of the FP7 EU SAM.SSA Project, coordinated by Elena Palomo Del Barrio, aims at checking out a simple to implement and efficient solution to discharge the storage unit at the specified power when needed this suggests having the ability to trigger nucleation at any time (or temperature) followed by a crystallization of the whole phase transition material in due time. Different techniques to crystallize Xylitol have hence been considered.

Finally, the feasibility of an innovative, efficient and low intrusive technique to activate the energy discharge is proven. Bubble agitation may be a very promising technique. Our work focuses on providing a far better understanding of the influence of bubbling on crystallization, on identifying key related variables and on paving the way for bubbling conditions optimization.

This work is partly presented at 6th International Conference on Theoretical and Applied Physics May on 16-17, 2019 held at Rome, Italy