

## Thermal Conductivity Measurements of Three Fatty Acid Mixtures as Potential Bio-Based Phase Change Materials for Low Temperature Energy Storage

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The latent heat thermal energy storage technique is an efficient and reliable means of using phase change materials (PCMs) to store and release thermal energy, because of its large heat storage capacity, and the nearly isothermal phase change behavior of PCMs. Many organic PCMs have been investigated as latent heat thermal energy storage materials [1, 2]. A rather new material class of organic-based PCM, here termed bio-based PCMs, are significantly less flammable than paraffin. Bio-based PCMs are a type of organic fatty acid ester PCMs made from underused and renewable feedstock, like vegetable oils. So they are cheaper than paraffin, and can be mass-produced. This work presents a study on some transport properties of three commercial bio-based PCM samples supplied by RGEES LLC (<http://www.rgees.com>), with melting temperatures of 37°C, 46°C and 53°C respectively, intended for low-temperature energy storage. The samples are mixtures of bio-based fatty acids. Experimental thermal conductivity was determined using a KD2 Pro Thermal Properties probe, whose measuring principle is the transient hot-wire method in the range  $0.02\text{--}4\text{ W}\cdot\text{m}^{-1}\cdot\text{°C}^{-1}$ . The thermal conductivity of the liquid and solid phase of the bio-PCM samples was determined, as well as the thermal diffusivity. The uncertainty of thermal conductivity determination in this case is estimated to be inferior to 3%. This paper is part of the Doctoral Thesis of D. Díez.

### References

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- [2] S. D. Sharma, K. Sagara, Latent heat storage materials and systems: a review, *International Journal of Green Energy* 2 (2005) 1–56.