Improved infrared thermography method for fast estimation of complex phase diagrams

Clément Mailhé 8, Marie Duquesne 9, Imane Mahroug 9, Elena Palomo del Barrio 5

Show more

https://doi.org/10.1016/j.tca.2019.03.005

Highlights

- Application of IRT method to estimate complex phase diagrams.
- Detection of complex phase transitions and data treatment automation.
- IRT results comparison with DSC measurements, literature and a thermodynamic model.
- IRT method limiting factors and influence parameters assessment.

Abstract

Phase diagrams are a primordial tool in materials science, gathering key information for the materials synthesis and the understanding of their formation processes. Numerous experimental techniques exist to determine the phase diagram of a binary system but they are time-consuming. The previously developed IRT method (InfraRed Thermography) enabled the fast determination of preliminary phase diagrams of polyols binary systems in which only liquid-solid and eutectic transitions occur. This method thus allows accelerating their screening step which is crucial before each development of a new material. This work aims at improving the transitions detection and at adapting the IRT-method to more complex phase diagrams containing eutectic, peritectic and metatectic transitions. To do so, the phase diagram of the capric-palmitic fatty acids binary system is experimentally determined using the improved IRT-method. It is then compared with those obtained using standard Differential Scanning Calorimetry measurements (DSC) and an improved thermodynamic model. Eventually, the limiting factors and the parameters of influence such as the material droplet size, as well as the nature and roughness of the substrate are investigated and discussed.