Photothermal Investigations of De-Emulsification of Fat/Water-Based Pasty Materials: Margarine

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Phase transitions in general are essential in many industrial sectors during fabrication, storage and conservation of products. Particularly for products that may easily experience aging or decay, like in food stuff or cosmetic industries, the understanding of the mechanisms and parameters governing undesirable phase transitions taking place after fabrication may play a crucial role for commercialization. New studies considering these problems as well as alternative techniques to deal with are therefore important.

In this work we study the phase transition process of the breaking apart of a fat/water-based emulsion system into its component parts by frequency dependent photothermal infrared radiometry providing depth dependent information on this process. In addition, a novel technique based on pyroelectric sensors has been developed which allows simultaneous measurement of dielectric and thermal properties of the sample as function of temperature. As an example for the application of these methods for measurement and analysis of de-emulsification we report here about studies performed on margarine. To this aim, thermal wave measurements in a reflection configuration have been carried out at several chosen fixed sample temperatures. Time dependent, –at a fixed modulation frequency– and modulation frequency dependent measurements have been performed. The time dependent measurements have been used to directly follow the temporal evolution of the de-emulsification from the induced changes upon the thermal transport properties of the system. The frequency dependent IR-measurements yield the thermal depth profile of the effusivity of the sample which points towards a gradual variation of the degree of de-emulsification from the surface towards the bulk. Passing through the phase transition the thermal diffusivity of the sample is found to vary more smoothly with temperature than the dielectric constant which is attributed to the sensitivity of the thermal properties to the topology of the emulsion.

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