Photothermal Measurements of the Thermal Properties of Micro-structured Materials Based on Magnetic Fluids

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A magnetic fluid (MF) is a suspension of ferromagnetic micro-particles inside of a certain liquid. In recent years, there has been an increasing technological interest in this kind of materials (also called magnetorheological fluids) due to the fact that they show controllable properties using an external magnetic field. Their typical uses range from damping control to lens polishing, but even more recently, the application of those fluids involve applications related to heat transfer properties manipulation. The present work is focused on the last application, by designing a composite material of iron micro-spheres in an epoxy resin matrix, and controlling their internal structure and composition, by changing the micro-particles concentration or the magnetic field strength.

In the presence of the external magnetic field, the iron particles forms a skeleton with the structure of multiple chains parallels to the magnetic field, so that, an anisotropic material is obtained. It is shown in this work, that this kind of composites could be used to produce materials with very different thermal conductivity and thermal diffusivity properties as a function of the angle between the iron micro-spheres skeleton and the normal propagation of heat.

The thermal diffusivity and conductivity of the obtained samples is measured using photothermal techniques due to their non destructive and high accuracy advantages.