

**PROJECT TITLE:** High Accuracy Photopyroelectric Calorimetry for Magnetic Nanofluids  
**PROJECT CODE:** PN-II-ID-PCE-2011-3-0036  
**CONTRACT NUMBER:** 7 from 05/10/2011

## **Progress Report 1**

### **General Objective: Mathematical model and preliminary experiments**

#### **1. Draw up of the general mathematical model and selection of the particular detection configurations for the measurement of thermal parameters of fluids.**

At this stage the general mathematical model for the PPE technique was developed. For this purpose we solved the system of thermal diffusion equations with boundary conditions: flux and temperature continuity at the interfaces of the layers of the detection cell. Finally, we obtained a general expression for the complex PPE signal, depending on all thermal and optical parameters of the layers of the detection cell.

Due to the fact that the general PPE equation is too complicated for experimental investigations, simplifications have been performed leading to particular cases of experimental interest.

We selected (i) as detection configuration both back and front configurations for the direct measurement of the thermal diffusivity and effusivity of the magnetic nanofluids, (ii) the thickness of the sample and the chopping frequency of radiation as scanning parameters and (iii) the phase and the amplitude of the signal as sources of information.

#### **2. Synthesis/acquisition of magnetic nanofluids with different structural parameters.**

The synthesis of magnetic fluids will be performed in our institute and/or in cooperation with the Laboratory of Magnetic Fluids, Romanian Academy, Timisoara Branch. The investigated ferrofluids will be based on organic non-polar solvents with single or double layers of surfactant and magnetite as magnetic nanoparticles.

Detailed results of this stage can be found in the Research Report 1 (Romanian).