PROJECT TITLE: High Accuracy Photopyroelectric Calorimetry for Magnetic Nanofluids
PROJECT CODE: PN-II-ID-PCE-2011-3-0036
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Progress Report 2

General Objective: PPE calorimetry for thermal diffusivity of investigation of magnetic nanofluids.

1. Selection of the detection configuration, draw up of the theoretical equations and setup of experimental parameters for the measurement of the thermal diffusivity.

In order to investigate the thermal diffusivity of the magnetic nanofluids, the back detection configuration was selected together with the chopping frequency or thickness scanning procedure. The information was collected from the slope of the phase of the PPE signal as a function of sampleôs thickness or sqrt. (f). Restrictions of thermally thick regime for the sensor and optically opaque sample were imposed.

In order to correlate the theory with experiment 215 µm and 500 µm thick $LiTaO_3$ pyroelectric sensors have been used, the frequency scanning range being 0.2Hz - 10Hz.

2. Increase of the performances of the PPE calorimetry for thermal diffusivity investigations.

An experimental set-up based on the thickness scanning procedure (TWRC method) with a minimum scanning step of 30 nm was designed. This approach eliminates the errors of the exact measurement of the sampleôs thickness. The information is collected from the phase of the BPPE signal (and not from the amplitude). The best method for data processing was a fitting procedure with two fitting parameters: the exact value of the liquidôs thickness and the value of the liquidôs thermal diffusivity. The final relative error for the value of the measured thermal diffusivity was less than1%. Special computer programs, based on LW software, were made both for data processing and acquisition.

3. Dissemination of the results

ISI journals.
1. Self-consistent measurement of all thermal parameters of a liquid by FPPE-TWRC technique, D. Dadarlat and M. N. Pop, AIP Conf. Proc. 1425, 13 (2012)
2. Contact and non-contact photothermal calorimetry for investigation of condensed matter. Trends and recent developments**,** D. Dadarlat, J. Therm. Analysis Calor. 110, 27 (2012)
3. Photopyroelectric (PPE) Calorimetry of Composite Materials, D. Dadarlat, M. N. Pop, O. Onija, M. Streza, M. M. Pop, S. Longuemart, M. Depriester, A. H. Sahraoui, V. Simon
J. Therm. Analysis Calor. DOI 10.1007/s10973-012-2270-1

International conferences
1. Frequency versus thickness scanning as self-consistent procedures in the photopyroelectric calorimetry, D. Dadarlat, 41th Winter School on Wave and Quantum Acoustics, Szczyrk, Poland, 27 Feb-03 March, 2012
2. Recent Developments in the Photopyroelectric Calorimetry of Condensed Matter, D. Dadarlat, Second Mediterranean International Workshop on Photoacoustic and Photothermal Phenomena, Erice, Italy,19-26 April 2012 ï invited

3. Basic aspects of the Photopyroelectric Method, D. Dadarlat, Second Mediterranean International Workshop on Photoacoustic and Photothermal Phenomena, Erice, Italy, 19-26April 2012 - invited
4. Photothermal Calorimetric Techniques Applied to Condensed Matter Materials D. Dadarlat, ATOM-N, Constanta, 23-26 august, 2012 ï invited
5. Functionalized polymer based magnetic nanostructures with controlled properties for magnetic drug targetingò, R. Turcu, I. Craciunescu, A. Nan, C. Daia, R. Tietze, J. Liebscher, C. Alexiou, L. Vekas, Conference ĂColloids and Nanomedicine 2012ò, Amsterdam, 15-17 iulie 2012
6. Hybrid particles based on nanosized magnetite encapsulated into polymers/copolymers R.Turcu, A. Nan, I. Craciunescu, L. Vekas, 10th Conference on Colloid Chemistry, Budapesta, 29-31 August 2012

Detailed results of this stage can be found in Research Report 2 (Romanian) and in the above mentioned disseminated papers.