High Resolution Studies of Thermal Parameters and Structural Evolution at Liquid Crystals Phase Transitions.

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Recent developments on photopyroelectric calorimetry for the study of phase transitions and critical phenomena will be presented. It will be shown that this technique allows high resolution simultaneous studies of thermal (specific heat, thermal conductivity and thermal diffusivity), optical (turbidity and birefringence) parameters as a function of temperature in anisotropic fluids such as liquid crystals (LC). A real time video imaging, that mimics a polarizing microscope for the studies of sample textures giving high resolution information on the sample structural evolution with temperature, is also built-in in the experimental set-up.

Results on the study of the kinetic of the Nematic-Isotropic phase transition in 8CB LC in aligned and not aligned samples will be presented. It will be shown that this strongly depends on the wetting properties at the surfaces in contact with the sample, but also on the thermal gradients induced in the LC during the measurements. A quantitative determination of the two-phase coexistence region at the transition has been obtained.

We have also studied the effects of disorder on the critical behavior of thermal parameters at the NI and Smectic A-Nematic phase transition. This has been done in three cases: LC cells with hybrid and twisted alignment and in samples where known quantities of small quartz particles (aerosil) was added. In all cases the behavior of thermal parameter strongly correlates with the evolution of disorder in the sample.