Poster (P-3)

NEMATICS IN CONFINED GEOMETRIES: AN ESR INVESTIGATION

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The investigation of liquid crystals in porous materials has become an attractive topic of research. Some investigations have revealed various new properties and effects which not observed when the liquid crystals are in the bulk [1]. The high surface to volume ratio characteristic porous materials permits the study of the surface interactions of nematogens particularly in the alignment of nematic order in the cavities and also the character of phase transitions, all of which depend on the size of the confining cavity [2].

We have sought to explore the competition between the surface interaction in the cavities and a magnetic field for the director alignment. To do this we have used ESR spectroscopy which is a powerful technique for the qualitative and quantitative study of the director distribution as well as the molecular orientational order parameter. The method requires an analytic form for the director distribution to analyse the ESR spectra and such a form has been obtained based on the integration of the torque-balance equation for an initially random director distribution [3]. From that, the extent of the director disorder can be determined from the ESR spectra and from this distribution the second rank director order parameter can be calculated analytically.

These studies have been performed for a commercial liquid crystal, ZLI-4792 obtained from Merck, confined in a cylindrically shaped, strongly curved and interconnected Controlled Porous Glass (CPG) obtained from Millipore. We have performed a series of ESR experiments with different cavity sizes (500, 700 and 1000 Å) and spin probes (Cholestane and Tempone). We have found an interesting result for the system Cholestane in ZLI-4792, where a newly significant ESR splitting appeared corresponding to that for a crystal. It suggests that there is a slow rotational motion of the molecule inside the cavities, whereas for the bulk sample, this motion is fast. We suspected that the spin probe might be absorbed by the CPG surfaces, and to study that, we used toluene in CPG as a control experiment. Last but not least, for every pore size and the two spin probes, we have measured the influence of increasing temperature on the dynamics using ESR spectroscopy.

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