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NMR Relaxation of Liquid Crystal Dendrimers

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Dendrimers are hyperbranched molecules resulting from sequential synthetic procedures, giving rise to practically monodispersed systems. The generation of a dendrimer is defined by the degree of branching. Low generation dendrimers (0, 1, …) are generaly flexible and of variable shape and, as the generation increases, the molecules tend more and more to a globular shape [1]. The specific functionalization of dendrimer molecules, most commonly in their outer shell, gives rise to systems with different types of applications both in biomedicine and in materials science, such as gene transfer and drug delivery agents, nanocatalysts, and contrast agents for NMR imaging [2]. Liquid crystal dendrimers combine the characteristics of dendrimers with those of liquid crystals, namely their peculiar molecular organization and anisotropic physical properties.

The molecular dynamics of liquid crystalline systems has been studied for many years, by means of proton NMR relaxation, combining standard and fast field cycling techniques covering very broad Larmor frequency ranges and probing different types of molecular motions from slow collective order fluctuations to fast molecular rotations/reorientations.

The study of liquid crystal dendrimers rises interesting questions with respect to molecular movements, namely how the structure of the mesophases and the corresponding molecular architecture influence the molecular dynamics as observed by NMR relaxation. Several NMR relaxation investigations have been done on this subject, relating flexibility and shape of LC dendrimer molecules, as well as the dendrimer generation, with molecular motions in these systems. This talk addresses some of these questions and corresponding proposed answers, obtained from experimental studies in LC dendrimers of different chemical structures and generations, exhibiting diverse types of liquid crystalline phases [3].

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