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NMR Relaxometry studies of the molecular dynamics and self-organized materials

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It is presented a brief review of NMR relaxometry studies in molecular systems that show different degrees of molecular self-organization and systems where low molar mass molecules are confined in in volumes at a nano-size scale. Liquid crystals are typically organic materials of anisometric molecules that may present different types of phases between the isotropic and the crystal phases, depending on temperature (thermotropics), concentration in a solvent (lyotropics), or both. Besides the local rotational/reorientational motions and translational self-diffusion, collective motions associated with fluctuations of molecular order and/or of the order director in the phase have been quantitatively described in terms of relaxation models developed for the different types molecular movements. The proton spin-lattice relaxation dispersion measurements over a broad range of frequencies, typically from a few kilohertz to hundreds of megahertz have shown that it is possible, in some cases, to identify and associate specific dispersion behaviors to particular types of collective motions and infer about differences in molecular packing and organization [1].

The study of the NMR spin-lattice relaxation dispersion in systems of confined low molar mass anisometric molecules in nano-size spaces (e.g. controlled porous glasses, porous membranes, etc.) has made possible to put into evidence the coupling between local rotations/reorientations and the translational self-diffusion processes under the influence of the confining walls topology (e.g. rotations mediated by translational displacements – RMTD). It is interesting to analyze different systems like liquid crystals under confinement in controlled porous glasses and ionic liquids in NAFION membranes [2-4].

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