Deuterium NMR studies in Cellulosic Networks

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Cellulose is the main constituent of plant cells and the mostly available polymer in nature. Some cellulosic materials show liquid crystalline phases both in lyotropic and thermotropic forms [1]. Apart from their mechanical properties, as seen in different polymer materials, they also present some remarkable optical properties. Thermotropic cholesteric esters were referred in literarture to undergo a
cholesteric-nematic transition upon shearing [2]. Electrostatic fibre spinning or electrospinning is a process for drawing fibers with sub-micrometer diameters through action of electrostatic forces [3]. Very interesting helical twisting of electrospun fibers made from liquid crystalline cellulose mixture has been reported recently by our group [3]. In this work we focus on the study performed by NMR of the dynamics and orientation distribution of deuterated 5CB dispersed inside micro and nano aligned fibers of a cellulosic network produced by electrospinning. The liquid crystalline cellulosic derivative and 5CB have been mixed at 17:3 weight ratio in acetone, where the ratio of the cellulosic ester and 5CB together with respect to acetone is 7:3. Electrospun fibers were made from this mixture and collected on a glass plate. The NMR spectra were obtained at different temperatures. Though 5CB´s clearing point is 108K, inside the nano and micro fibers it shows liquid crystalline properties even at higher temperatures. Simulation of NMR spectra obtained upon temperature variation has been performed and the results show a continuous phase transition of LC inside the cellulosic fibers network. Typical NMR spectrum from the non woven cellulosic mat with liquid crystal along with the curve fitting is given in figure 1. The continuous 5CB transition to the isotropic phase can be observed in figure 2.

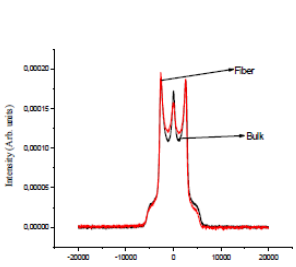

Figure 1

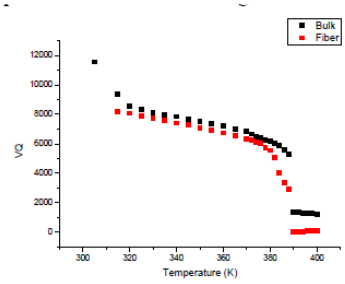

Figure 2

Fig1 shows a typical NMR spectrum of APC and 5CB mixture in bulk and fiber and Fig2 shows the variation of fitting parameter VQ with temperatures in both of bulk and fibers.

References:
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