USE OF ATOMIC AND SMALL MOLECULAR PROBES IN AN NMR STUDY OF A FERROELECTRIC LIQUID CRYSTAL AND A NOVEL CRUCIAL TECHNIQUE TO STUDY BIAXIALITY OF THERMOTROPIC LIQUID CRYSTALS

Jukka Jokisaari[1], Anu M. Kantola[1], Juhani Lounila[1] and L. Petri Ingman[2]

[1] NMR Research Group, Department of Physics, University of Oulu, Finland
[2] Department of Chemistry, University of Turku, Finland

NMR spectroscopy of noble gases (neon and xenon) and methanes ($^{13}CH_4$ and CD_4) was used to investigate the properties of ferroelectric FELIX-R&D liquid crystal (product of Merck). The liquid crystal possesses the following phases: X $\rightarrow$ 279 K $\rightarrow$ Smectic C* (SmC*) $\rightarrow$ 327 K $\rightarrow$ Smectic A (SmA) $\rightarrow$ 332 K $\rightarrow$ Nematic (N*) $\rightarrow$ 341 K $\rightarrow$ Isotropic (I)[1]. ^{1}H, ^{2}H and ^{13}C NMR spectra of the methanes, ^{21}Ne NMR spectra of ^{21}Ne-enriched neon, and ^{129}Xe and ^{131}Xe NMR spectra of natural-abundance xenon dissolved in the liquid crystal were recorded over a temperature range that covers the isotropic phase and all the mesophases. Such experiments give a body of information which makes feasible to form a diverse picture about the properties of a liquid crystal on the one hand and about the effect of liquid crystal on the properties of a solute atom/molecule on the other hand[2].

The comparison of the ^{129}Xe and ^{131}Xe NMR spectra of xenon in a liquid crystal is proposed a decisive method to reveal conceivable biaxiality of thermotropic nematic liquid crystals. Furthermore, such comparison of results obtained in smectic C/C* phase can be used to derive temperature dependence of the tilt angle or that of the electric field gradient in case the tilt angle is known from some other experiments. The method will be illustrated using “conventional” thermotropic nematogens and the above-mentioned FELIX-R&D as samples.[3]

[1] Data sheet / Hoechst AG/1995-Jul-19.
[2] J. Jokisaari and P. Ingman, submitted.
[3] J. Jokisaari, A. Kantola, J. Lounila and P. Ingman, submitted.