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DIELECTRIC STUDIES OF THE STRUCTURE IN SOME HOMOLOGOUS SERIES OF ESTERS AND THEIR MIXTURES

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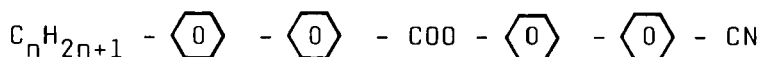
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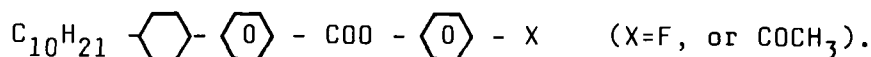
Abstract The results of electric permittivity and conductivity measurements for mesogens from the CBnAB ($n = 5 - 8$) homologous series and for the mixtures of CB7AB with 10XPCHB ($X = F$ or COCH_3), are presented.

INTRODUCTION

It has been observed that in some mixtures, the polar smectic A_1 phases are immiscible.^{1,2} In the phase diagrams of such mixtures one observes on one side a destabilization of the smectic phase leading to the appearance of the nematic gap, and on the other side an extension of the smectic phase region and the appearance of the reentrant nematic phase. Such a behaviour was observed^{1,2} in mixtures composed of the following classes of compounds: 4'-cyanobiphenyl-4'-n-alkylbiphenyl-4-carboxylates (CBnAB):^{3,4}



and 4-(trans-4-n-decylcyclohexyl)benzoates (10XPCHB)



In the present paper the dielectric properties of these compounds and their mixtures are discussed.

RESULTS AND DISCUSSION

Figure 1 presents the results of dielectric measurements obtained for compounds of the homologous series CBnAB ($n=5\div 8$). The large value of permittivity ϵ_{\parallel} , due to the presence of the strongly polar -CN group, decreases as the length of the alkyl chain increases. For the CBnAB series with $n=5$ to 7 at the N- S_{A1} phase transition one observes a strong decrease of conductivity measured along the director (σ_{\parallel}) what is typical when a layer structure occurs. Whereas an increase of the perpendicular component of conductivity (σ_{\perp}) on transition from N to S_{A1} is anomalous. This behaviour is probably related to the specific structure of the smectic A_1 layers. The studies by Gramsbergen and de Jeu⁵ have shown that in a similar class of compounds (with the -CN polar group) smectics A_1 have locally ordered dipoles like in the \tilde{A} smectic structure.

In CB8AB the reentrant nematic phase separates the smectic A_d and A_1 phases. The conductivity component σ_{\perp} is insensitive to the phase transitions, while the component σ_{\parallel} shows only a small increase on transition from A_d to RN. The value of anisotropy of conductivity in the RN phase is $\sigma_{\parallel}/\sigma_{\perp} > 1$, which means that ordering of the RN phase in CB8AB is different from that of the nematic phase of compounds CBnAB for $n \leq 7$.

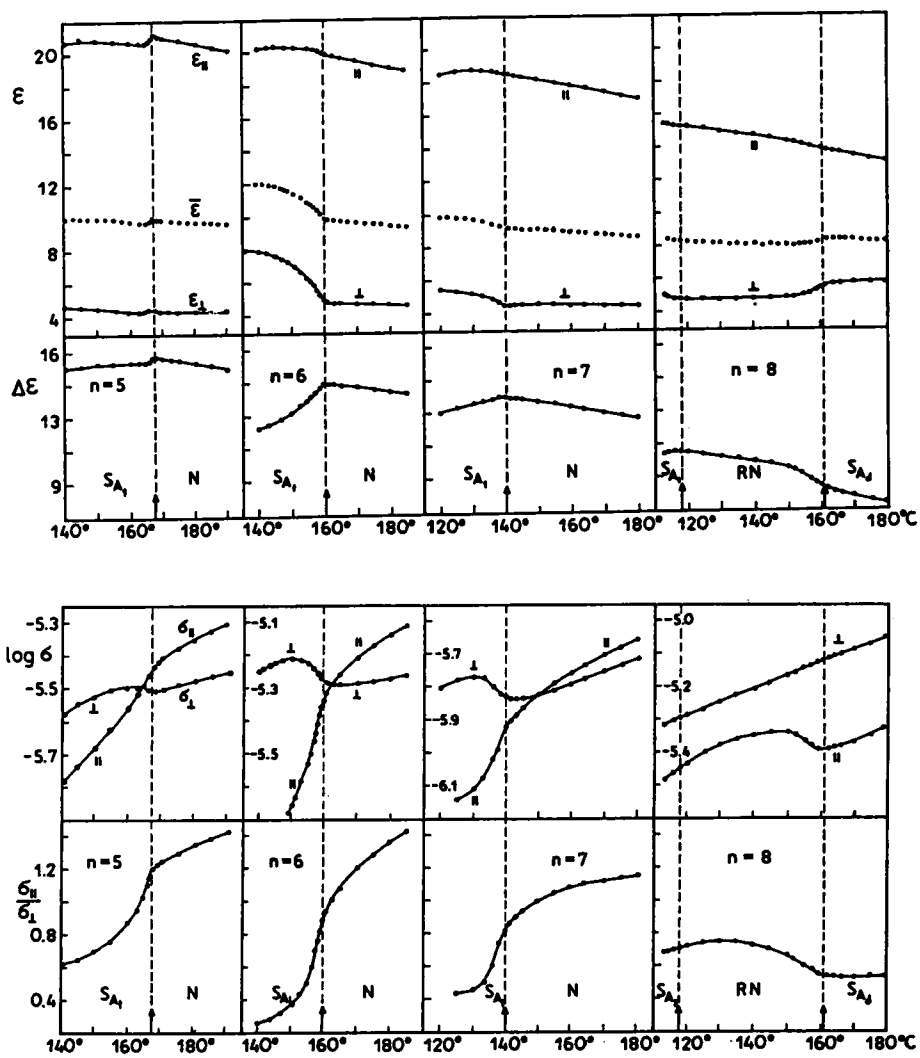


FIGURE 1 Electric permittivity and conductivity for the CBNAB compounds.

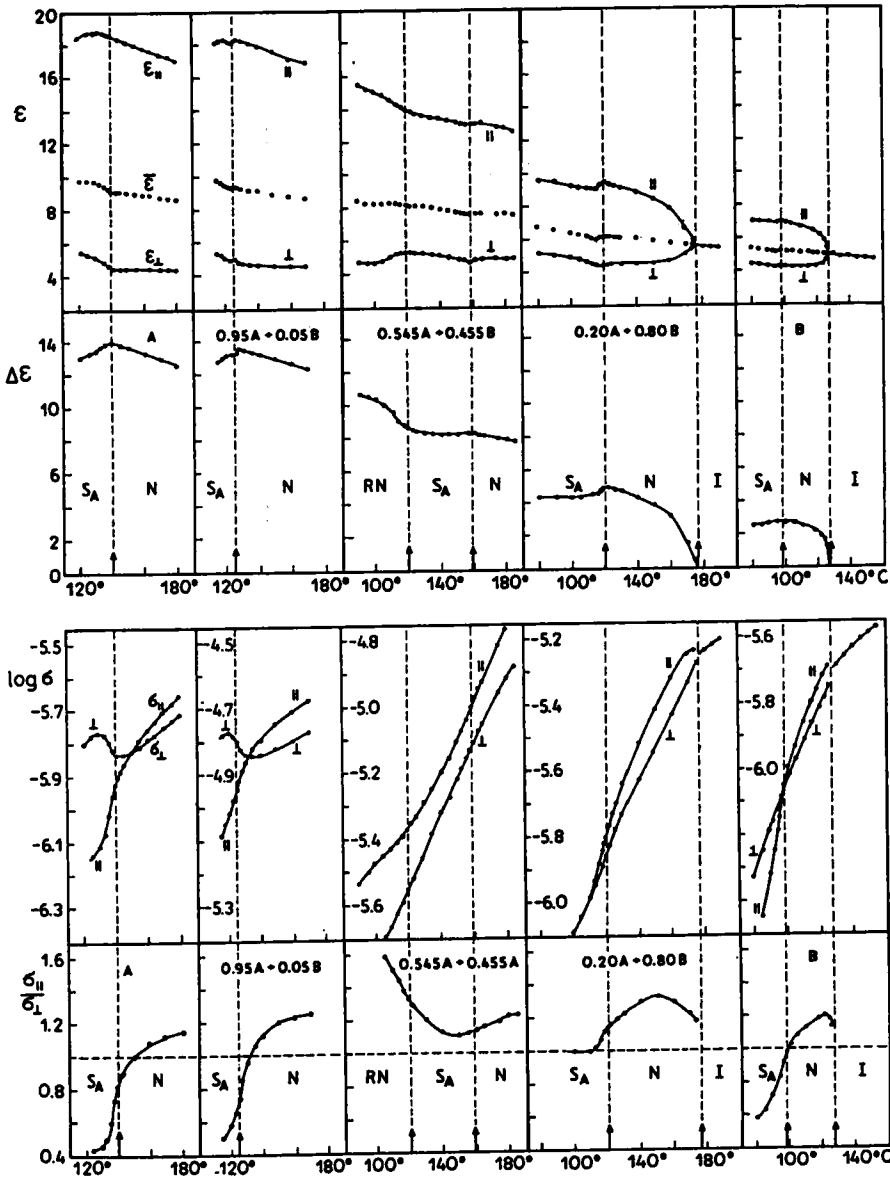


FIGURE 2 Electric permittivity and conductivity for the CB7AB (A) + 10FPCHB (B) mixtures.

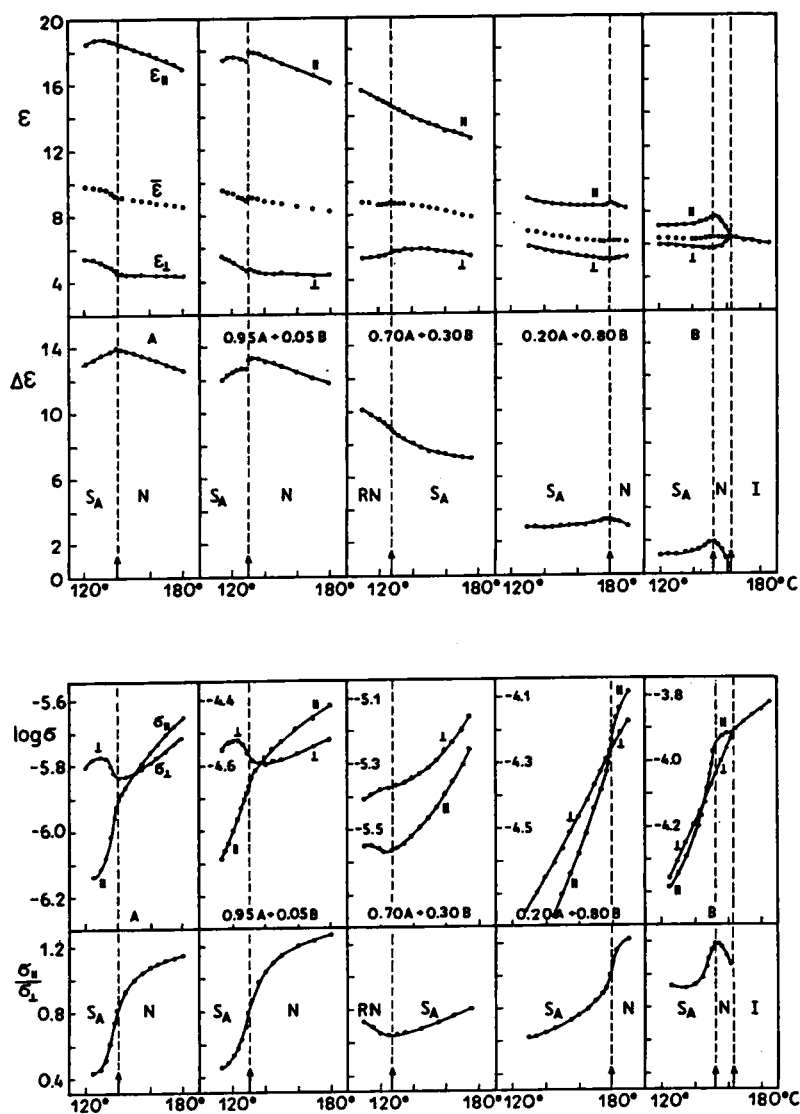


FIGURE 3 Electric permittivity and conductivity for the CB7AB (A) + 10APCHB (B) mixtures.

The results of dielectric studies of CB7AB+10FPCHB and CB7AB+10APCHB mixtures are presented in Figs.2 and 3, respectively. The dielectric anisotropy $\Delta\epsilon$ in 10FPCHB and 10APCHB is much lower as compared with CB7AB what is due to the lower polarity of the -F and -COCH₃ terminal groups. The behaviour of both component of conductivity $\sigma_{||}$ and σ_{\perp} is typical for smectics A₁.

The reentrant nematic phase appears in both these mixtures. Electric conductivity data show that the properties of the reentrant nematic phase in the mixture CB7AB+10FPCHB (Fig.2) are analogous to those observed in the 80CB+60CB system.⁶ The anisotropy of conductivity $\sigma_{||}/\sigma_{\perp} > 1$ in the two nematic phases and in the smectic phase. The properties of the reentrant nematic phase in the CB7AB+10APCHB mixture are different (Fig.3). The anisotropy of conductivity $\sigma_{||}/\sigma_{\perp} < 1$ in both RN and S_A phases similarly to the pure CB8AB.

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