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New Series Exhibiting Pure Enantiotropic Nematic Reentrant Compounds at Atmospheric Pressure

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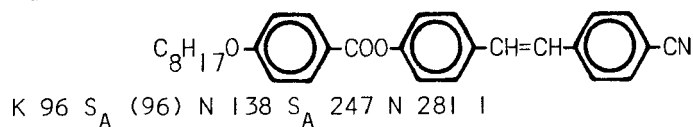
NEW SERIES EXHIBITING PURE ENANTIOTROPIC NEMATIC
 REENTRANT COMPOUNDS AT ATMOSPHERIC PRESSURE

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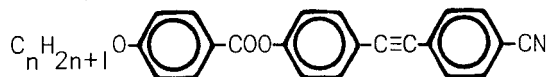
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ABSTRACT: Some derivatives of an homologous series of 4-alkoxy-benzoyloxy-4'-cyanotolanes are synthesized. Two of them exhibit a stable nematic reentrant phase at atmospheric pressure.

INTRODUCTION: Some reentrant nematic phases have been recently described in binary mixtures¹ but, up to now, only one pure substance with this type of diagram at atmospheric pressure has been published.^{2,3} It is a three phenyl-ring compound with a strong dipolar moment substituent⁴ with the following formula and transition temperatures.

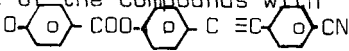


A systematic study of the different properties of this series will be published elsewhere.⁵ Our project was to find new liquid crystal families with the same properties. In connection with this, we have prepared an homologous series of new compounds with the following formula:



RESULTS AND DISCUSSION: The different transition temperatures observed with a polarizing microscope and by differential scanning calorimetry are given in the following Table.

The temperatures are in Celsius; K = crystal phase; S_A = smectic A phase; N = nematic phase; I = isotropic phase; . = The phase is a real one; ____ = the phase is not observed; () = monotropic transitions; T_{NA}, T_{NI} are

TABLE : Transition temperatures of the compounds with the general formula : $C_n H_{2n+1}$ 

n	K	S _A	N	S _A	N	I	$\frac{T_{NA}}{T_{NI}}$
6	. 113	-	-	. (107)	. 268	.	0.70
7	. 102	-	-	. 108	. 256	.	0.72
8	. 86	-	-	. 96	. 248	.	0.70
9	. 90	. (75.7)	. 141	. 183	. 239	.	0.89
10	. 84	-	. 102	. 208	. 233.5	.	0.95

respectively the temperature in Kelvin of a smectic A - nematic or a nematic-isotropic transition at the highest temperature.

The first three derivatives (n=6, 7, 8) exhibit only a smectic A and a nematic phase, but the nonyloxy derivative presents a stable reentrant nematic phase; below this nematic phase and from 75.7°C, another smectic A phase is observed (monotropic phase). Finally, let us point out that the decyloxy derivative presents only three phases with increasing temperature: N, S_A, N. The identification of these phases has been made using several techniques.

OPTICAL TEXTURE OBSERVATIONS: On cooling the isotropic liquid of the nonyloxy derivative one can observe the nematic phase with a classical thread-like texture. Below this nematic phase the smectic A phase with a focal conic or homeotropic texture appears. On further cooling another thread-like texture is observed followed by a focal conic and homeotropic phase.

ISOMORPHISM: The identification of the smectic A phase of the octyloxy derivative has been made by the miscibility method with the S_A phase of the 4-cyano-4'-heptyloxybenzoyloxystilbene⁴ (Figure 1). The successive N, S_A, N, S_A phases of the nonyloxy derivative have been checked with the miscibility of the four corresponding phases of the 4-cyano-4'-octyloxybenzoyloxystilbene^{2,3} (Figure 2).

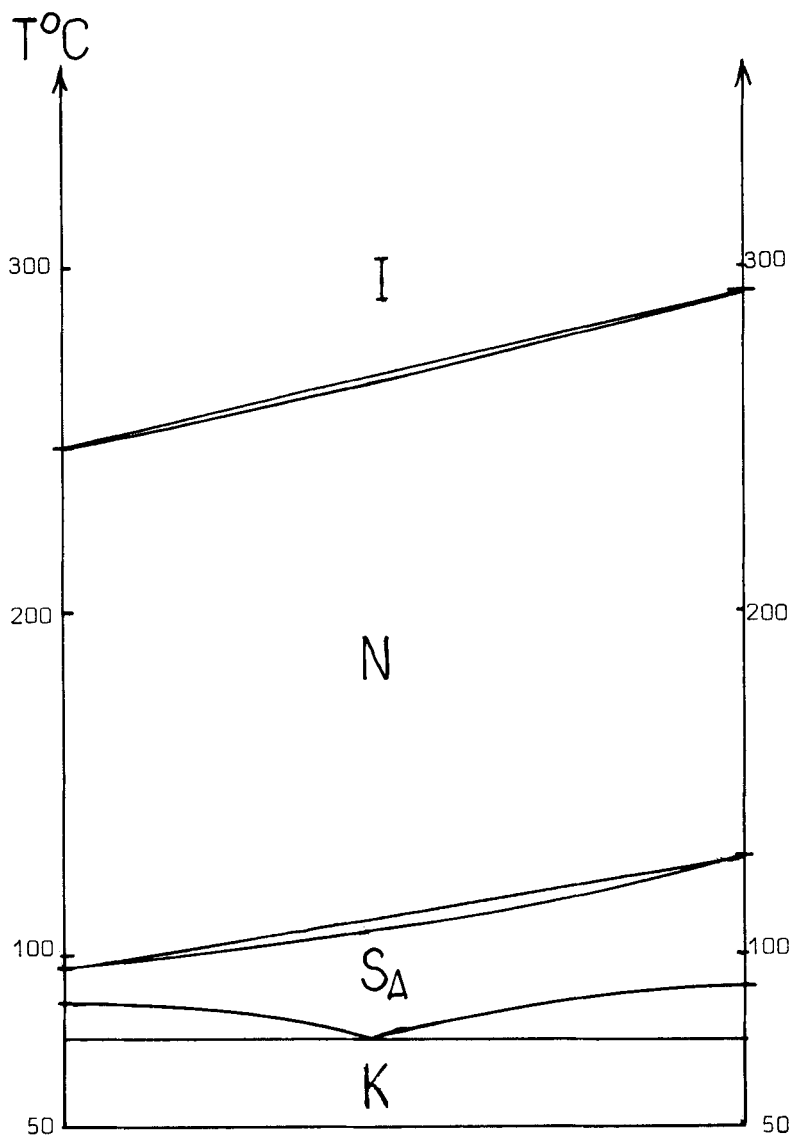
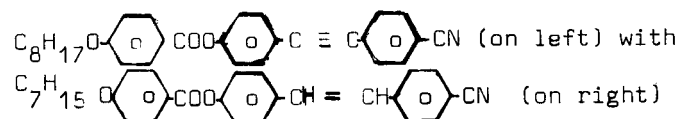


FIGURE 1 Diagram of isobaric state for the mixture of



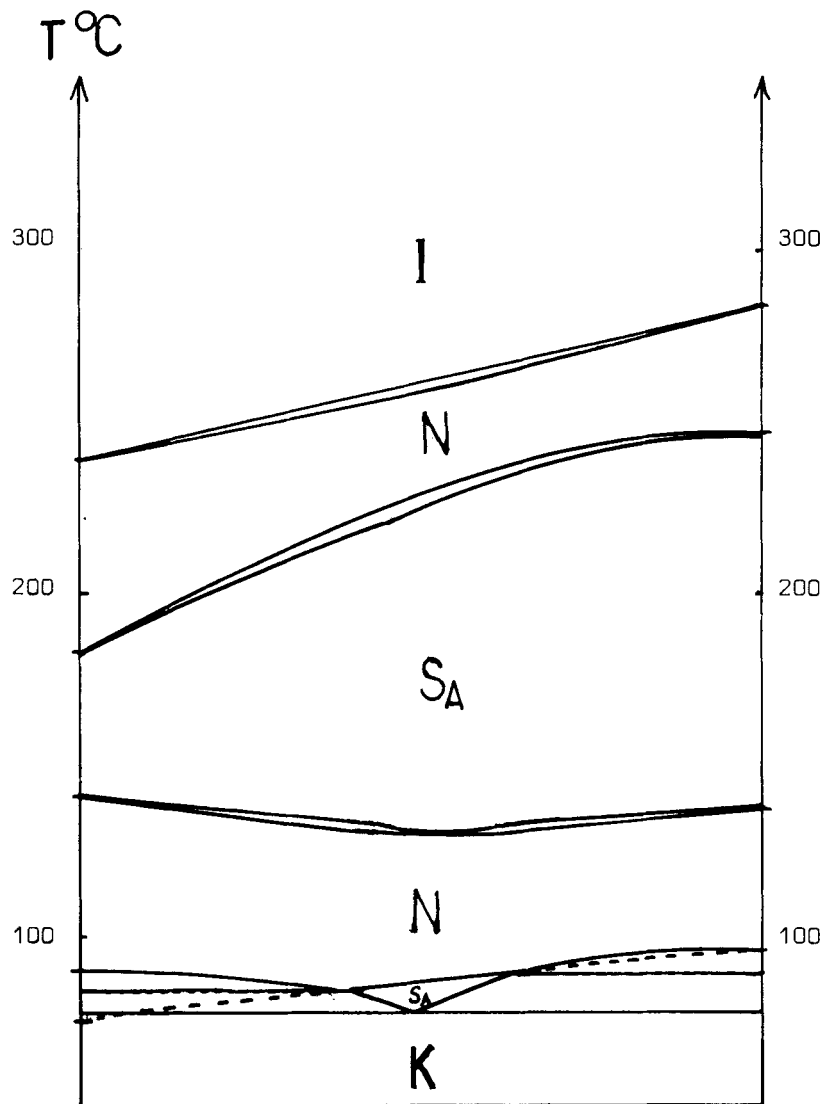
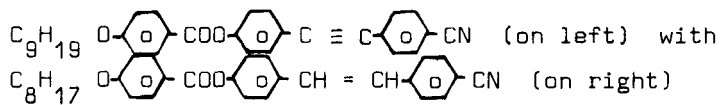


FIGURE 2 - Diagram of isobaric state for the mixture of



The importance of the molecular length and of the strong dipole moment ($-\text{CN}$ for instance) result in the formation of bimolecular layers. The reentrant phenomenon itself will be discussed elsewhere as well as the absence of the correlation between the $T_{\text{NA}}/T_{\text{NI}}$ McMillan parameter⁶ and the heat of transition.

CONCLUSION: Some pure products of a new liquid crystal series with three benzene cores exhibit a reentrant nematic phase at atmospheric pressure. The complete synthesis will be published elsewhere.

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