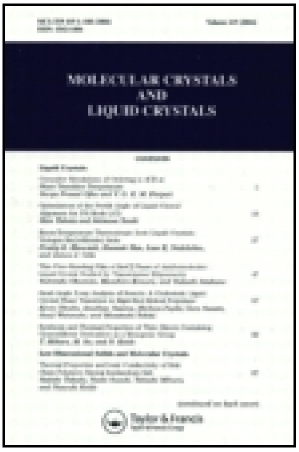

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# Behaviour of the Smetic C Phase in Bicomponent Mixtures

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# BEHAVIOUR OF THE SMECTIC C PHASE IN BICOMPONENT MIXTURES

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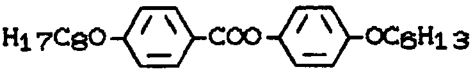
Abstract Phase diagrams of binary systems containing liquid crystalline components with smectic C phases have been investigated. It has been shown that the difference of tilt angles of components is important but not the decisive factor which determines the thermostability of the smectic C phase of the mixtures.

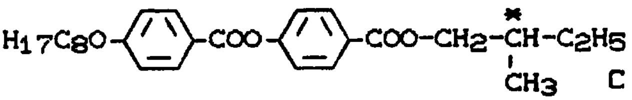
## INTRODUCTION

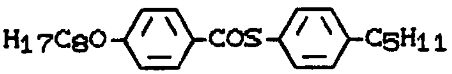
Our aim was to find simple relationships between the molecular length and the tilt angle of single compounds and the shape of their miscibility diagram.

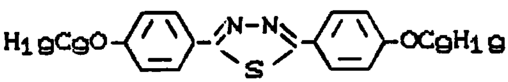
## EXPERIMENT

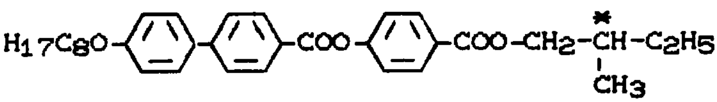
Following are the formulae of the used compounds and their phase transition temperatures ( in °C ) together with the lengths(in nm) of their molecules in their most extended conformations calculated using known bond lengths and bond angles. In some cases, when it was possible to make X-ray investigations according to the method presented in [1], tilt angles $\Theta$ at temperatures 10° distant from the transition point $S_C$-$S_A$ are also given. Tilt angles were calculated as $\cos^{-1}(d_C/d_A)$ where $d_C$ is the smectic layer thickness at the temperature 10° below the transition point $S_C$-$S_A$ and $d_A$ is the smectic layer thickness at the transition point. For compound 1, which has no smectic A phase, $d_A$ was evaluated as the sum of $d_A$ for compound 6 and the length of $-C_2H_4-$ group.

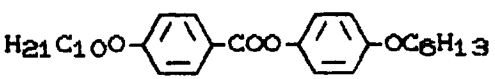

l=3.28 Θ=24° 1
C 55 $S_C$ 66.5 N 90 I

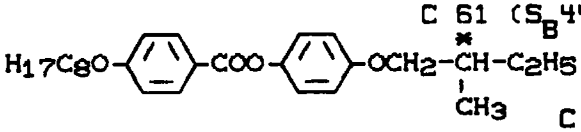

l=3.15 Θ=12° 2
C 35.5 ($S_C$ 30) $S_A$ 56 I

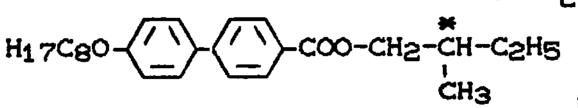

l=3.11 3
C 60 ($S_C$ 53.5) $S_A$ 62.5 N 86.5 I

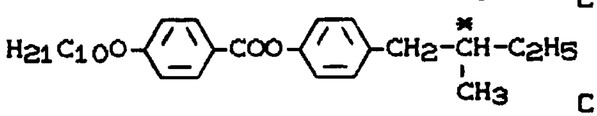

l=3.92 4
C 97 $S_C$ 187 I


l=3.55 Θ=11° 5
C 67 $S_C$ 142.5 $S_A$ 189 I


l=3.53 Θ=18° 6
C 61 ($S_B$ 44) $S_C$ 77 $S_A$ 83 N 89.5 I


l=3.03 Θ=20° 7
C 42.5 $S_C$ 43.5 $S_A$ 60 I


l=3.03 8
C 50.5 $S_C$ 42 $S_A$ 64.5 I


l=3.28 9
C 42.5 $S_A$ 44 N 47 I

The phase diagrams shown in figure 1 were made by thermooptically measuring phase transition temperatures of binary mixtures. Tilt angle measurments as a function of temperature for compounds 2,7,8 shown in figure 2 were made by the electro-optical method[2] using 5 μm cell.

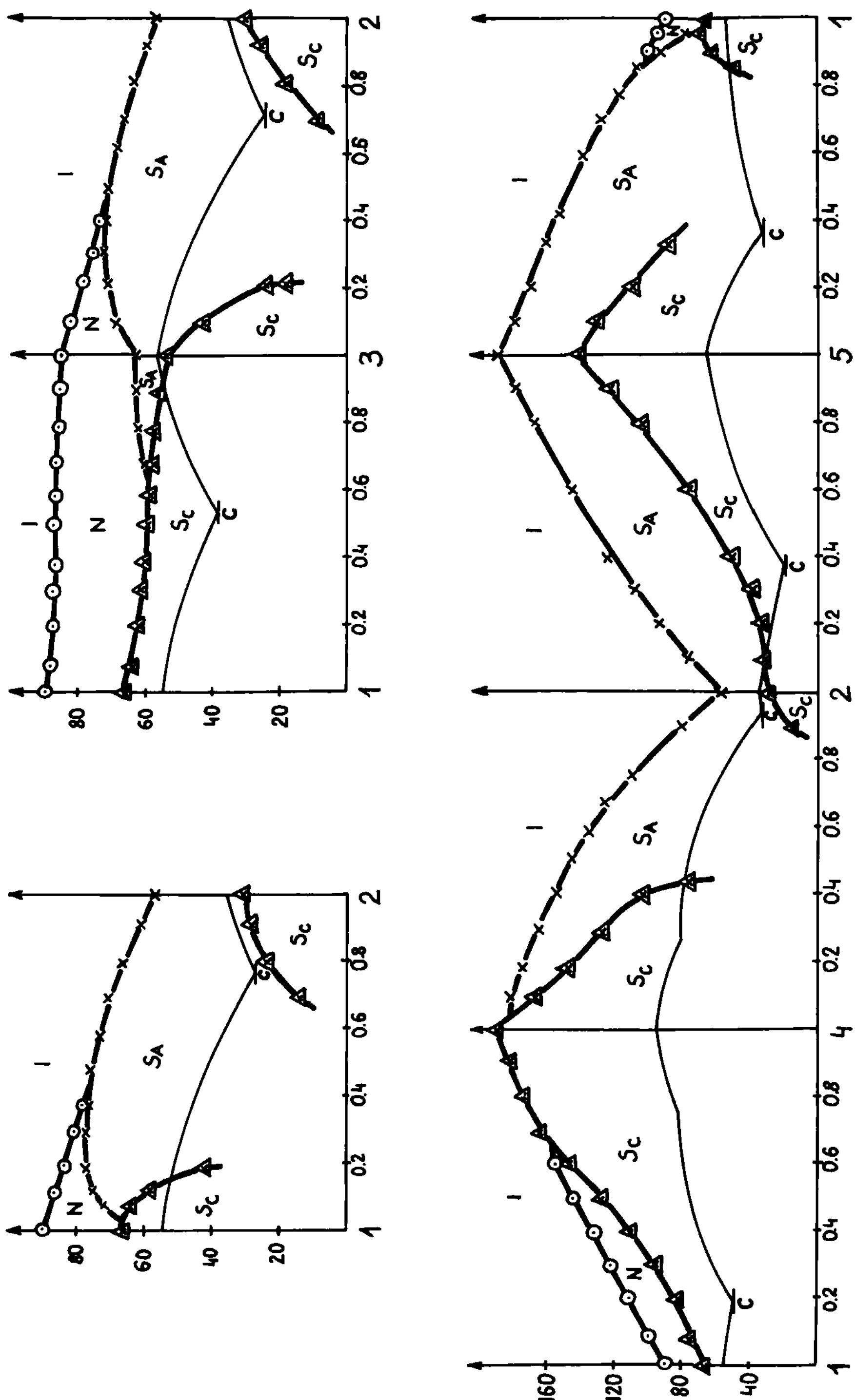



FIGURE 1 Phase diagrams

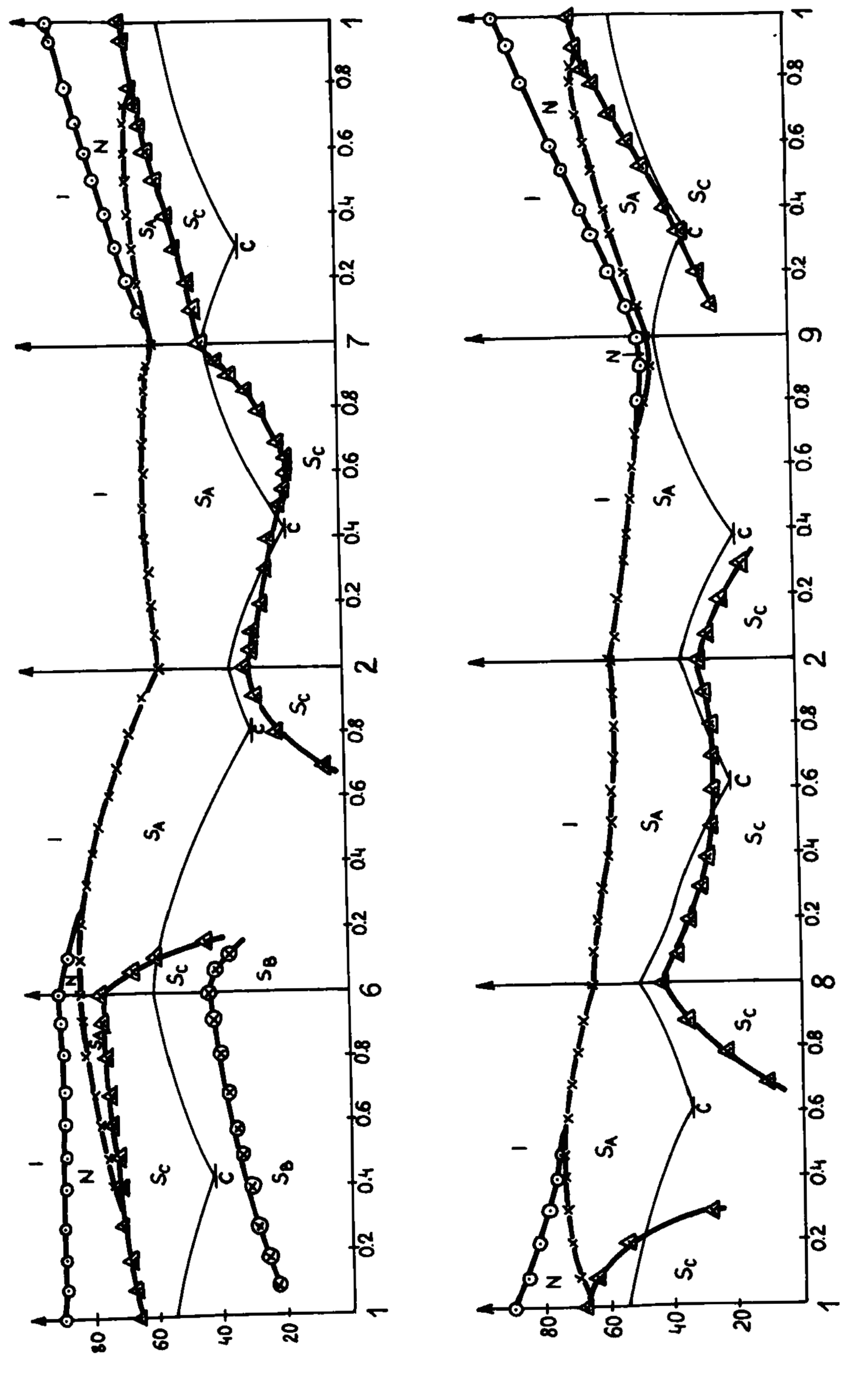



FIGURE 1 continued

## DISCUSSION

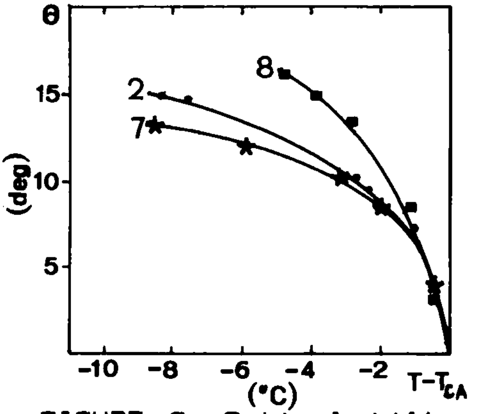



FIGURE 2. Optical tilt angles vs temperature

Compounds 1 and 2 were chosen as basic components of the investigated binary mixtures, because they differ in tilt angle. It is easily seen that all compounds with the exception of compound 7 may be assigned to two exlusive groups. The first group form compounds 3,4,6 and 9 which on phase diagram give a continuous line connecting the upper limit of smectic C phase with compound 2 giving gap in the central region of concentration. While the second group forms compounds 5 and 8 giving a continuous line with compound 2 and a gap with compound 1. This indicates importance of uniformity of tilt angles in regarding the behaviour of the smectic C phase in bicomponent mixtures. The example of compound 7 shows, however, that the difference of tilt angles of components is not the decisive factor which determines the thermostability of the smectic C phase of the mixtures. No direct correlation between the ratio of molecular lenght (all the molecules are nearly the same size) and the phenomenon of destabilizatin of smectic C phase could be found.

It seems that ivestigated phenomenon is too complicated to be explained taking only isolated factors into consideration. More detailed investigation is needed.

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