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Paramagnetic nematic liquid crystals

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Abstract. The paper reports new nematic liquid crystals that are paramagnetic.

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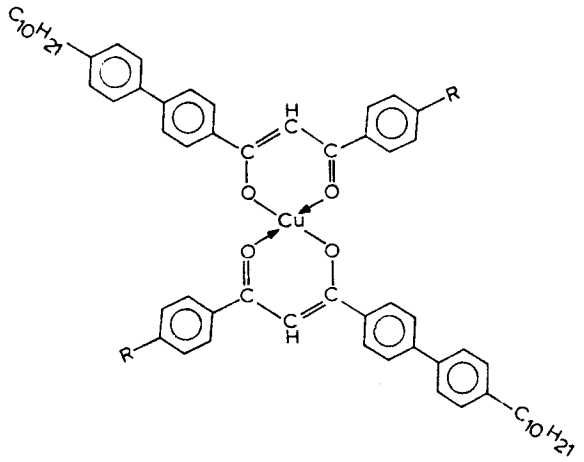
Several thousands of compounds are now known to exhibit the nematic phase (see, for example, Demus *et al* 1974; Kelker and Hatz 1980, and references contained therein) and as far as we are aware all of them are diamagnetic. We present here what we believe are the first examples of paramagnetic nematic liquid crystals.

The compounds investigated were bis[1-(*p*-*n*-decylbiphenyl) 3-(*p*-methoxyphenyl)propane-1,3-dionato] copper (II), and the corresponding ethoxy derivative:



(A) $R = OCH_3$
(B) $R = OC_2H_5$.

The synthesis of these compounds, hereafter referred to as compounds (A) and (B) respectively, will be described in a later paper.

The nematic phase occurs monotropically in both compounds. The temperatures of the melting transition and of the monotropic isotropic-nematic transition are respectively: for (A) 194·0 and 178·5°C and for (B) 173·0 and 158·7°C.

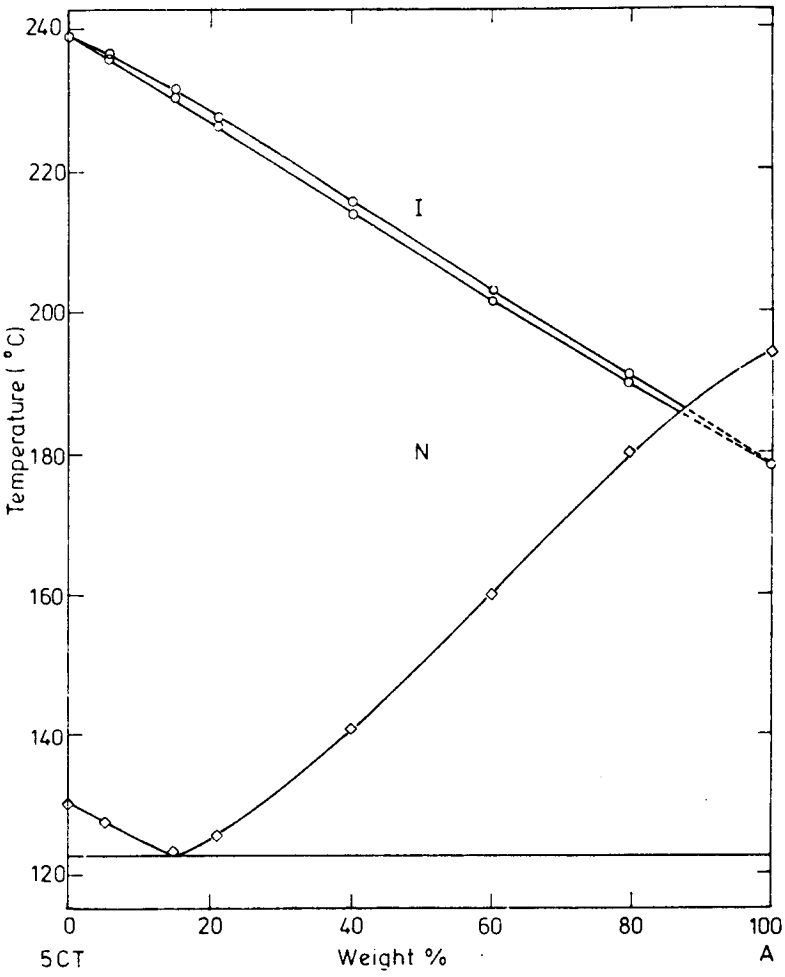


Figure 1. Miscibility diagram of 5CT with compound A. Squares represent the solid-nematic or solid-isotropic transitions determined in the *heating* mode, and circles the isotropic-nematic (I-N) transitions determined in the *cooling* mode. The dashed lines signify monotropic transitions.

The miscibility of (A) with the well-known nematogen 4″-*n*-pentyl-4-cyano-*p*-terphenyl (5CT) was investigated. The phase diagram, shown in figure 1, confirms that the mesophase of (A) is of the usual nematic type. It was also verified that the nematic phases of (A) and (B) are continuously miscible.

Preliminary measurements using a Cahn RG balance yielded the following values of the mean magnetic susceptibility χ in the three phases of compound (A):

Polycrystalline sample at 27°C	$\chi = +0{\cdot}9$	$\times 10^{-6}$ emu/g
Polydomain nematic at 175°C	$\chi = +0{\cdot}14$	
Isotropic liquid at 200°C	$\chi = +0{\cdot}06$	

Further studies on these and other similar compounds are under way and will be reported in detail elsewhere.

We are grateful to the Solid State and Structural Chemistry Unit, Indian Institute of Science, for allowing us to use the Cahn RG balance.

References

Demus D, Demus H and Zaschke H 1974 Flussige Kristalle in Tabellen, VEB Deutscher verlag fur grundstoff industrie, Leipzig

Kelker H and Hatz R 1980 *Handbook of liquid crystals* (Weinheim: Verlag Chemie)

Note added in proof

We have just come across an abstract of a report in Russian (Galyametdinov *et al* 1986) on a liquid crystalline metal complex forming nematic mesophase.

Galyametdinov, Yu G, Zakieva D Z and Ovchinnikov I V 1986 *Izv. Akad. Nauk SSSR, Ser. Khim* (2), 491