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Preliminary communication

Synthesis and properties of some semi-fluoroalkoxy chain liquid crystals

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Six compounds with semi-fluorinated chains have been synthesized. When the terminal hydrogen atom in the semi-fluoroalkoxy chain was changed to chlorine, both the clearing point and the melting point were enhanced. It was also found that the clearing points were decreased and melting points increased with the introduction of a triple bond into the cores.

In recent years many liquid crystalline compounds with fluorocarbon chains have been synthesized [1–10]. Earlier work by different groups on liquid crystals with perfluoroalkyl or semi-perfluoroalkoxy chains showed that the smectic mesophases and their thermal stabilities were enhanced. In particular, molecules with semi-perfluorinated chains, exhibit tilted smectic properties. For further study of the effect on physical properties of the semi-perfluorinated chains, six compounds have been designed and synthesized. By subtle modification of the fluorocarbon chain, more detail about this kind of compound can be learnt.

The compounds were obtained by routes depicted in the scheme. Fluoroalkanols **1** and **2** were synthesized simply as shown; all the other intermediates and final compounds were synthesized according to literature methods [11]. The phase behaviour of the final compounds is summarized in the table; it was determined with differential scanning calorimetry and polarizing optical microscopy [11].

All six compounds are enantiotropic liquid crystals. For compound **A**, only the smectic C phase was found and the liquid crystalline range was narrow; but if the terminal hydrogen atom in semi-fluoroalkoxy group was changed to chlorine (compound **B**), the melting and clearing points were increased. The liquid crystalline range was broadened by 12.6°C with this subtle modification. For compounds **C** and **D**, enantiotropic SmA and SmB phases were found. With the same (H/Cl) change, the thermostabilities of the SmA and SmB phases were enhanced; however the SmA phase range was broadened while the SmB phase range was narrowed. In compounds **E** and **F**, with the same H/Cl change, the SmB phase disappeared.

Table. Phase transition temperatures of compounds synthesized. Cr = crystal; SmA = smectic A phase; SmC = smectic C phase; SmB = smectic B phase; I = isotropic liquid; Recr = recrystal.

Compound	Transition temperatures/°C
A	Cr 94.0 SmC 96.2 I 94.3 SmC 82.0 Recr
B	Cr 96.6 SmC 111.1 I 108.9 SmC 90.0 Recr
C	Cr 60.9 SmB 94.3 SmA 157.1 I 154.7 SmA 92.9 SmB 59.8 Recr
D	Cr 87.4 SmB 99.0 SmA 166.3 I 164.5 SmA 98.3 SmB 72.8 Recr
E	Cr 81.1 SmB 88.0 SmA 150.8 I 148.3 SmA 86.7 SmB 63.2 Recr
F	Cr 104.6 SmA 156.1 I 153.7 SmA 96.1 Recr

It was also found that with the introduction of a triple bond, the melting points were increased, but clearing points were decreased and SmB phase ranges became narrow.

In conclusion, with the change of the terminal hydrogen atom of the semi-fluoroalkoxy chain to chlorine, both the clearing and melting points were enhanced and lower order liquid crystalline phases were favoured. Further work will be carried out to study this effect.

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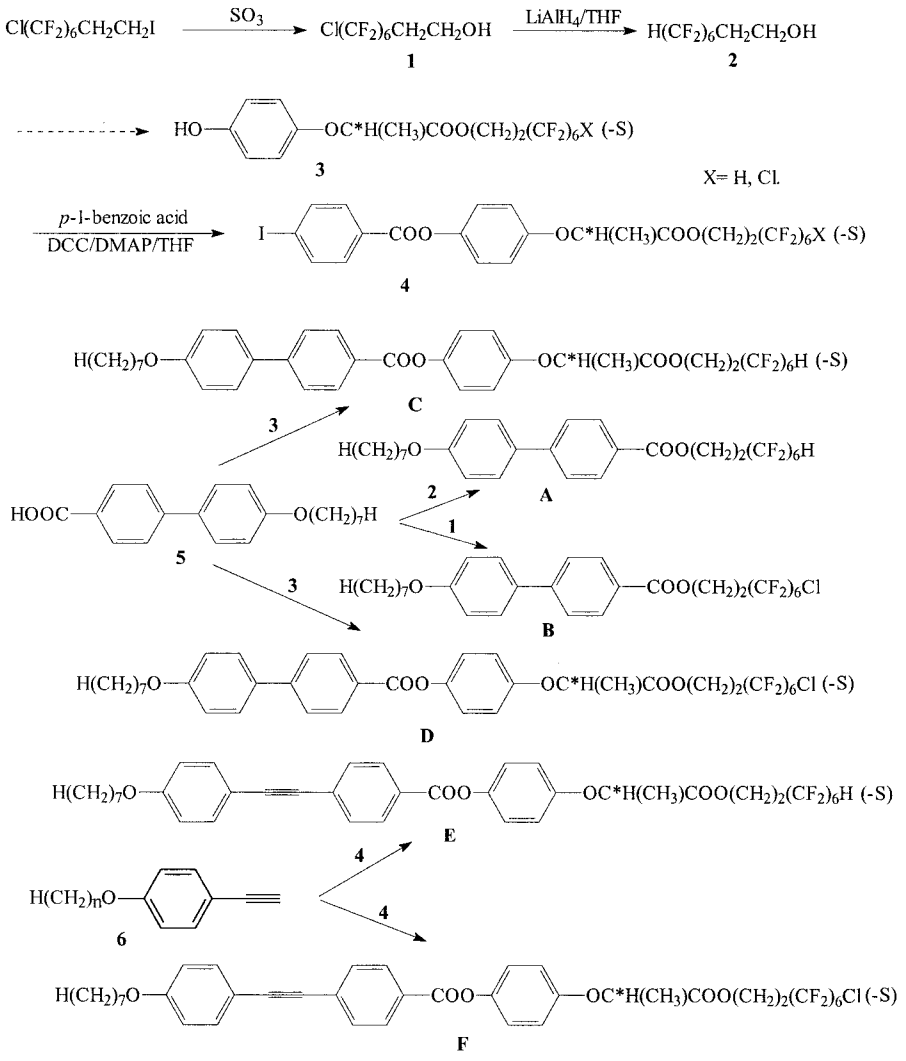

Scheme. Synthesis route for compounds **A–F**.

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