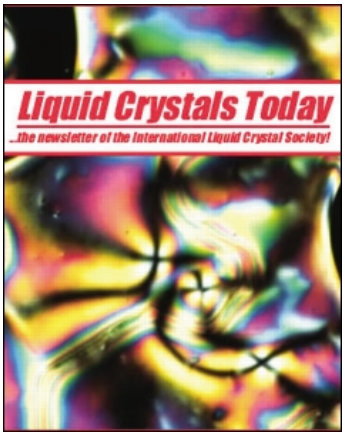

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Material Highlights: Liquid Crystal Polymers

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Material Highlights: Liquid Crystal Polymers

A Digest of the Recent Literature

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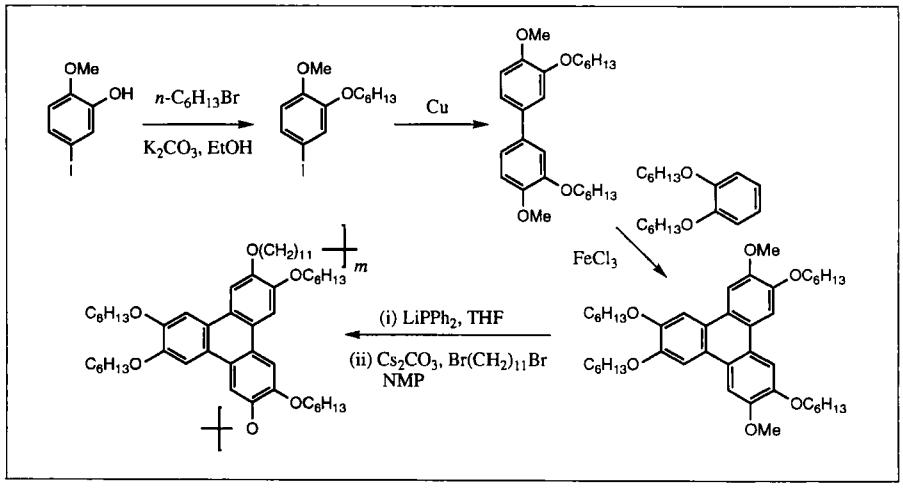
A key issue in the area of side-chain liquid crystal polymers concerns the conformation of the backbone within the mesophase. In order to resolve this matter, Noirez and co-workers (*Liquid Crystals*, 1995, 18 129) have studied a wide range of polymers exhibiting both nematic and smectic behaviour using small angle neutron scattering. Their results combined with a survey of those in the literature reveal that if the polymer is solely nematogenic, then the backbone adopts a prolate conformation in which on average it lies along the director. By contrast, in a smectic phase the backbone adopts an oblate shape and on average lies perpendicularly with respect to the director. This arises from a microphase separation in which the backbones are distributed between the mesogenic layers. However, the backbones can cross the mesogenic layers although their ability to do so depends on, amongst other factors, the degree of polymerization. If the polymer exhibits both nematic and smectic behaviour, then in the nematic phase the backbone adopts a slightly oblate shape resulting from smectic fluctuations.

Liquid crystal polymers incorporating discotic mesogenic units have been known for a number of years but their study has been greatly curtailed by the lack of gram quantities of structurally homogeneous materials. A new synthetic methodology has now been developed by Boden and his colleagues (*J. Am. Chem. Soc.* 1995 **117** 924) using which, for the first time, large amounts of single-isomer main-chain polymeric discotic liquid crystals can be conveniently prepared. The key step in the synthetic route is the assembly of the triphenylene core through the oxidative



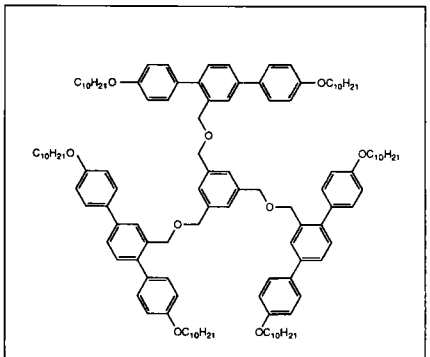
coupling of phenyl and biphenyl residues. The coupling reaction is followed by demethylation and subsequent condensation with an α,Ω-dibromoalkane to yield the polymer. The Scheme shows this route for a 2,7-linked main-chain polymer but other structural isomers are readily prepared using this method. The ready availability of these polymers will now allow their properties and exciting application potential to be evaluated.

The study of model compounds of polymers gives an important insight into the properties of the polymers themselves. Andersch and co-workers (*J. Chem. Soc., Chem. Commun.*, 1995, 107) have described two new types of model compounds in which the mesogenic units are laterally attached.

Surprisingly both these compounds exhibit exclusively smectic A behaviour and in addition **1** exhibits a glassy state. These materials should prove not only to be important in understanding the properties of laterally attached main-chain polymers but also **1** may stimulate the design of new liquid crystalline polymeric architectures.

Liquid crystal block copolymers are attracting increasing attention for both fundamental and technological reasons. Adams and co-workers (*Macromol. Chem. Rapid Commun.*, 1994, **15**, 879) have expanded the range of such structures known to exhibit liquid crystallinity to include amorphous/liquid crystalline/ amorphous triblock copolymers,

This material was prepared by performing polymer analogous reactions on anionically synthesized polystyrene-*block*-1,2-polybuta-



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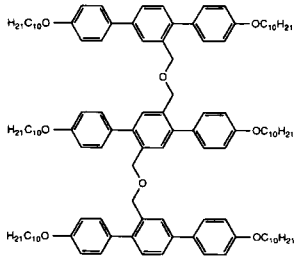

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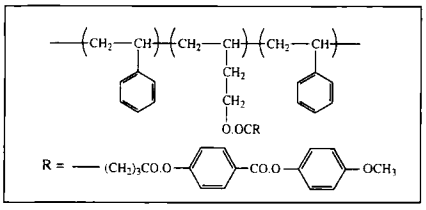

diene-*block*-polystyrene. The block ratio of polystyrene/liquid crystal was approximately 10 wt % / 90 wt % and this resulted in a morphology in which spherical polystyrene domains act as physical crosslinks in a liquid crystal matrix. The authors noted that these materials can be thought of as thermoplastic liquid crystalline elastomers.

In aqueous solutions, ionic surfactants and oppositely charged polyelectrolytes form complexes which precipitate out of solution. The properties of these complexes in non-aqueous solvents and in the solid state are now being studied. Antonietti and Conrad (*Angew. Chem. Int. Ed. Engl.* 1994 **33** 1869) investigated the polyelectrolyte-surfactant complex formed on mixing polyacrylic acid and dodecyltrimethylammonium chloride. The isolated complex in the solid state exhibits a highly ordered liquid crystalline structure in which the polyelectrolyte is embedded in a continuous alkyl matrix. The polymer chains occupy cylinders in which they are almost fully extended and such a morphology although well known in nature, prior to this study did not have a synthetic analogue.

Society NEWS

International Liquid Crystal Conferences in 1998 and 2000

The International Liquid Crystal Conferences (ILCC) organized on behalf of the Society, provide a unique forum in which to learn of the most recent and the most exciting research in the field. A key element in the success of these conferences is the choice of enthusiastic and efficient organizers as well as a sympathetic location. This choice is made well in advance of the conference, in fact normally four years before the event. At this stage, the Society invites detailed bids from those wishing to host the meeting. However, in 1994, it was decided to accept such applications not only for the 17th ILCC in 1998 but, in view of its special significance, for the 18th ILCC to be held in the year 2000 and so allow ample time for its planning. Extremely strong bids were received by the Chairman of the Conference Committee, Professor Hans Rainer Trebin. Under his expert guidance, the bids were considered in depth by the Board of Directors and the results of these considerations are now known. I am pleased to announce that by a very clear majority, the Board of Directors has decided that in 1998, the 17th ILCC will be held in Strasbourg (France) while in 2000, the 18th ILCC will take place in Nagoya (Japan). Both are exciting venues; in 1998, the Society will return to France after an absence of 20 years while in 2000 we shall be back in Japan also after 20 years.

The 17th ILCC will be in capable hands of Professor Antoine Skoulios as Conference Chairman together with Professor Daniel Guillon as the Secretary. The Conference will be held in the splendid Palais de La Music et des Congress and the provisional dates are 20–24 July 1998. Clearly, there is much planning to be done but what is promised now is the active participation by Professor P.G. de Gennes and Professor J.M. Lehn in the Conference. This is clearly going to be a scientific treat which we can look forward to with eager anticipation. It will be well matched by the famous cuisine of Strasbourg and beautiful region of Alsace.

The 18th ILCC will be the responsibility of Professor Shunsuke Kobayashi, the Vice-President of the Society, and Professor Koji Okana. They have selected Nagoya, Design City for the 21st century, as the venue for ILCC 2000. Nagoya is a modern, vibrant city with historical traditions dating back to the 17th century; the conference will be held in the Nagoya Congress Center.

Liquid Crystals Today and Tomorrow

Since the inception of the International Liquid Crystal Society in 1990, the Newsletter *Liquid Crystals Today* has played a significant role in the development of the Society. In addition, the Newsletter provides a valuable source of information to our members not only about the Society's affairs, but also about developments in the subject. Thanks to David Dunmur's enthusiasm, vision and hard work, *Liquid Crystals Today* has proved to be an outstanding success as all of its readers will be aware. The Newsletter did, however, constitute a significant financial burden on the Society's limited resources which, in turn, has its impeded development and growth. For the past year or so, David and I have been exploring the possibility of entering into a partnership with a publisher in order to produce *Liquid Crystals*