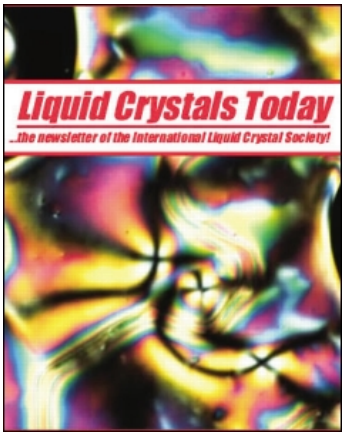

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Meeting report – Nematic Biaxiality, 16 January 2009, University of Hull, UK

Professor Andrew Masters

University of Manchester

After many false dawns, the existence of a biaxial nematic phase in thermotropic systems appears to have been firmly established. While this phase is hardly common-place, an impressive amount of experimental, theoretical and modelling research has now accumulated and a meeting to take stock and look to the future was certainly necessary. We are grateful to Georg Mehl for organising this excellent workshop and providing us with a much-needed break during the grey January days.

The morning session had a polymer/NMR theme, with presentations on nematic elastomers (Dr A. Hoffman, Freiburg, Germany) and tetrapodes (Professors C. Cruz and J.L. Figueirinhas, Lisbon, Portugal).

When I first saw the structure of a tetrapode, I could not for the life of me see why it did anything other than form jelly – it seemed so far removed from the normal rigid rod/disc shapes beloved of theoreticians! Nevertheless it seems able to wrap itself up in such a way as to form the biaxial phase. Professor Cruz explained how ^{2}H NMR could be used to probe this biaxiality while Professor Figueirinhas discussed how these molecules might pack together. Apparently if you cut the strings between the 'podes', then the monomers do not exhibit a biaxial phase. It was suggested that the short chains connecting the podes did not allow free-rotation and this imposed some extra biaxiality on the system. Interestingly, this same idea figured in the very first talk by Dr Hoffman on nematic elastomers – again restricted rotations about short chains was posited to encourage biaxiality. Jumping ahead to the afternoon session, however, the modelling calculations of Dr Wilson seemed to suggest that restrictions to rotation in organosiloxane tetrapodes were pretty slight. A proper molecular-level understanding of this curious system still seems to be elusive.

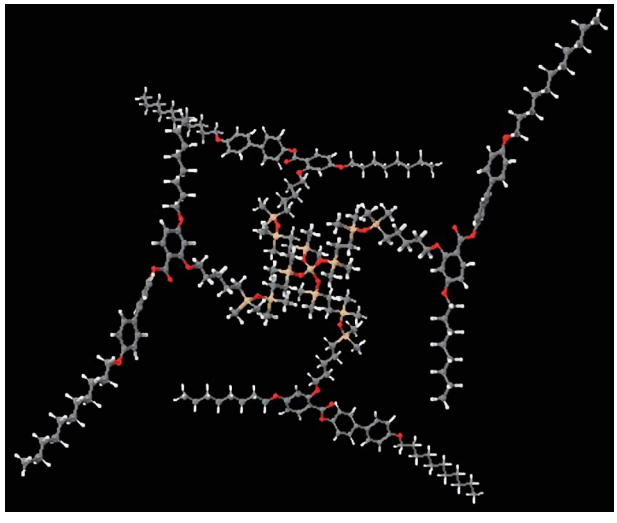

Figure 1. Molecular model of organosiloxane tetrapode, shown to form a biaxial nematctic phase (courtesy of Dr Mark Wilson, University of Durham).

Generous portions of lunch, helped down by generous portions of wine, kindly supplied by Kingston Chemicals, were followed by a UK-based afternoon session. There were talks on simulation/theory themes by Professor Jackson (Imperial) and Dr Wilson (Durham), on synthetic themes by Professor Bruce and Dr Görtz (York) and on electro-optic themes from Drs Benzie and Salter (Oxford). Professor Jackson described how the biaxial nematic phase for a rod-plate mixture could be stabilised by a certain class of attractive forces, while Dr Wilson concentrated on atomistic simulations of bent-core molecules, showing how electrostatic forces rather than hard-core shape determined biaxial nematic stability. The presentations by Professor Bruce and Dr Görtz gave an overview of the properties of a variety of linked rod-disc dimers and bent-core molecules. A striking feature of asymmetric bent-core molecules was their propensity to form chiral domains of opposite handedness – something which linked very strongly to the talk by Dr Salter where a very similar effect was observed. This close connection between biaxiality and chiral domains is again fascinating and warrants some serious theoretical/modelling attention. Finally, if one is to use biaxial nematics in devices, much needs to be understood about surface anchoring and how molecular orientations change under the action of applied electric fields. The two Oxford electro-optic talks indicated that such important studies are in full flow.

Naturally the above is an incredibly brief, totally biased view of a really good meeting and I apologise for the inevitable prejudices and misunderstandings. It certainly made me think it was a really good time to get back to working on biaxials!

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