



# LIQUID CRYSTAL MATERIALS RESEARCH CENTER *SPECIAL SEMINAR SERIES*

## Smectic Clusters in Bent-Core Fluids

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Nematic liquid crystals of rod shape molecules are 3 dimensional fluids with long - range orientational order. Nematic and isotropic phases of bent-core molecules are viscoelastic with viscosity 2-3 orders of magnitude higher than in their rod-shape counterparts. [1] These rheological studies and recent X-ray results [2,3] give indirect evidences for the existence of smectic clusters, *i.e.* small regions of space in which molecular centers are arranged in a two-dimensional layered structure, but where the correlation between molecular position decays quickly with distance. It has long been known [4,5,6] that similar short-range correlated “cybotactic groups” may also exist in calamitic liquid crystals, but in that case they resulted from critical, pre-transitional fluctuations of the smectic order parameter as one approached the nematic-smectic transition. In this talk we will summarize the results in [1-3], and discuss electrical properties of binary mixtures [7,8] of bent and rod-like molecules. We will also describe interesting correlations with results of flexoelectric studies [9]. The direct observation of the clusters to be carried out in collaboration between Kent State and the University of Colorado at Boulder will allow quantitative explanation of all the prior results listed in references [1,2,8,9] and will provide important insight into the interaction between bent and rod-shape molecules.

[1] C. Bailey et al., *Soft Matter*, **5**, 3618 - 3622 (2009); C. Bailey et al., *Physical Review Letters*, **103**, 237803 (2009).

[2] S. H. Hong et al., submitted to *Soft Mater.* (2010).

[3] O. Francescangeli et al., *Adv. Func. Mater*, **19**, 1-9 (2009).

[4] A. Gudkov, *J. Struct. Chem*, **33**, 436-442 (1992).

[5] A. de Vries, *Mol. Cryst. Liq. Cryst.* **10**, 219-236 (1970).

[6] W.L. McMillan, *Physical Review A*, **8**, 328 (1973).

[7] G.G. Nair et al., *Adv. Mater.*, **20** (16), 3138 – 3142 (2008).

[8] P. Salamon et al., *Phys. Rev. E* in press (2010).

[9] A. Jákli et al., *Proc. of SPIE*, **.911**, 691105-1(2008).

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