

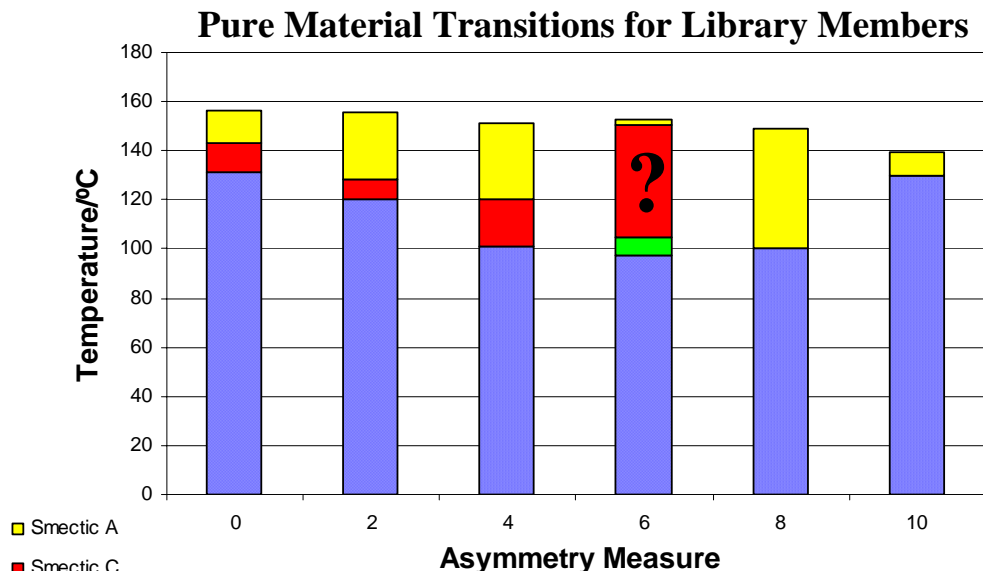
# A systematic study of structure and physical properties of the smectogenic 2,7-diacyl fluorenes

Professor Gerald R. Van Hecke, Harvey Mudd College, CHE-0353662

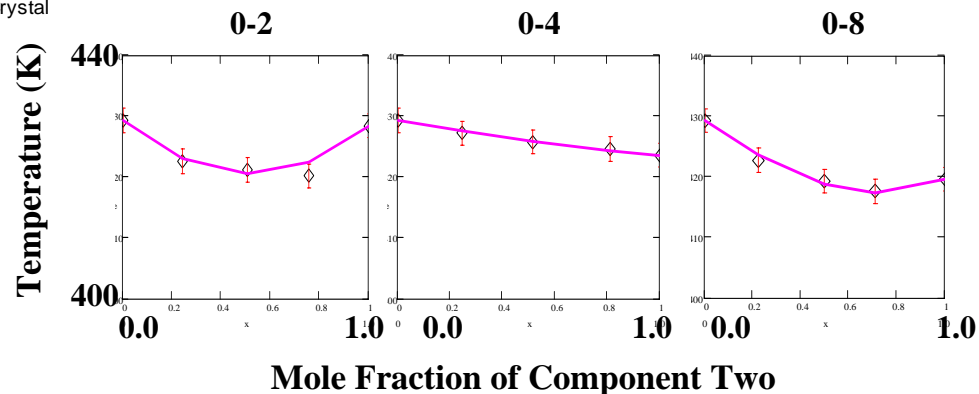
## Research Experiences for Undergraduates

Our library of 2,7-diacyl fluorenes and binary mixtures of its members exhibit smectic, crystalline and isotropic phases. These molecules are of the form C<sub>n</sub>-FL-C<sub>m</sub>, where FL is the fluorene core and C<sub>n</sub> and C<sub>m</sub> are acyl chains where n+m=18. Asymmetry measure for a given member is defined as  $|m-n|$ . We aim to better understand the influence of subtle structural changes on liquid crystalline behavior. OPM and DSC are used to explore phase behavior and determine thermodynamic constants. The binary T-x phase diagrams show non-ideality that has been quantified using Equal Gibbs analysis, assuming  $\Delta G^E = Ax(1-x)$ .

Undergraduate student Aurora Pribram-Jones (HMC '08) created theoretical phase diagrams for the smectic A to isotropic transition of binary mixtures of the smectogens, which were then compared to DSC SmA-I transition onset temperatures. Comparison of Equal Gibbs analysis parameters allows investigation of possible trends due to asymmetry. A new smectic E phase was identified in asymmetry measure 6, as well as a suspected smectic C.



■ Smectic A  
■ Smectic C  
■ Soft Crystal Smectic E  
■ Crystal



Theoretical SmA-I phase diagrams using EGE (predicted in magenta, DSC in red). Asymmetry of mixture components label diagrams above.

Asymmetry	0	2	4	6	8	10
0		-894	-62	-538	-611	-607
2			0.003	0.012	-0.002	-847
4				-450	-486	-471
6					-443	-384
8						-421

A from  $\Delta G^E = Ax(1-x)$ , based on DSC onset temperatures for the SmA-I transition of each mixture. Units: J/mol.