

Hydrogen-bonded liquid crystals: Polymeric networks utilizing rigid tetrafunctional netpoints



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Wiegel Research:
Caring from
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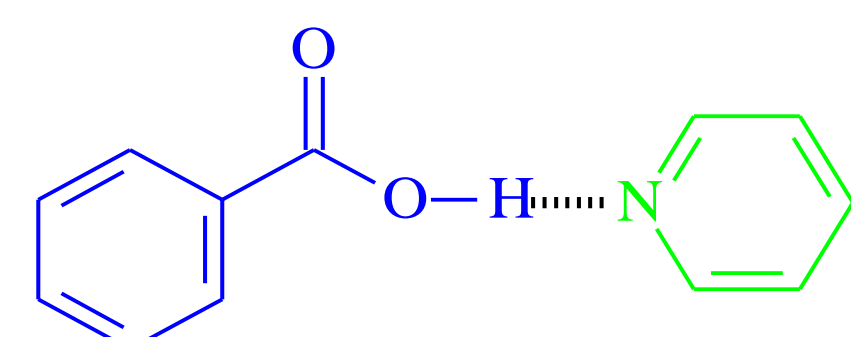
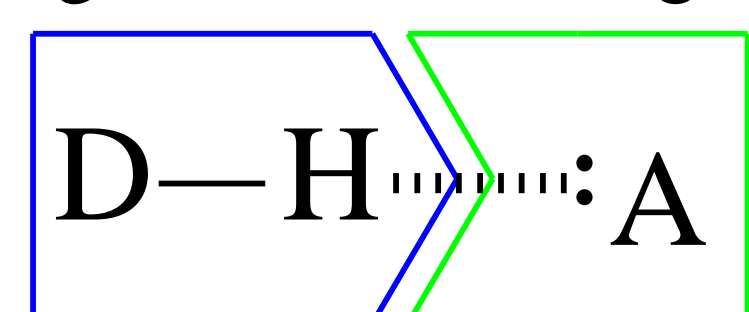
Background

Liquid Crystals

- Materials that exhibit long-range and some short-range directional ordering in a fluid state.
- Composed of mesogens (shaped molecules) and flexible spacers
- Different types of mesogens based on molecular shape (calamitic: rod-shaped)

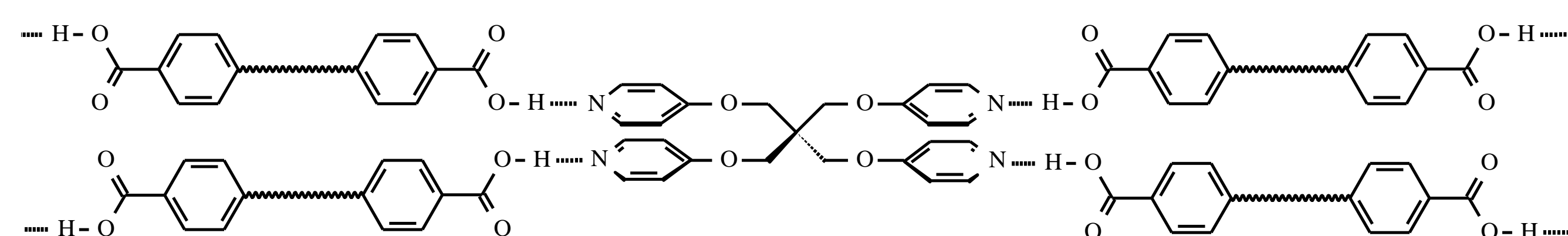
Molecular Self-assembly Through Hydrogen Bonding

Non-covalent interactions formed between two molecules through a hydrogen-bond resulting in a larger "associated" molecule

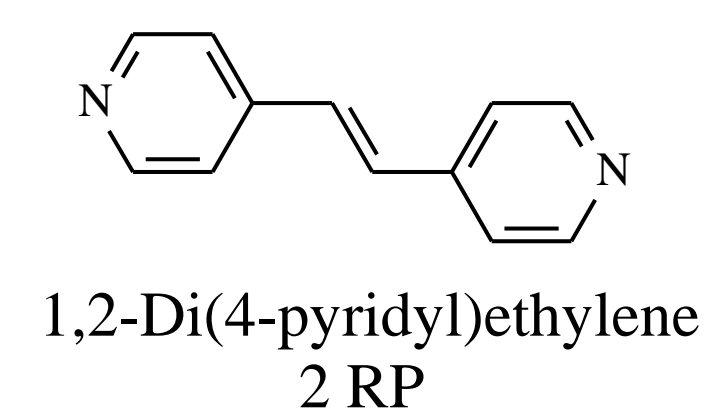
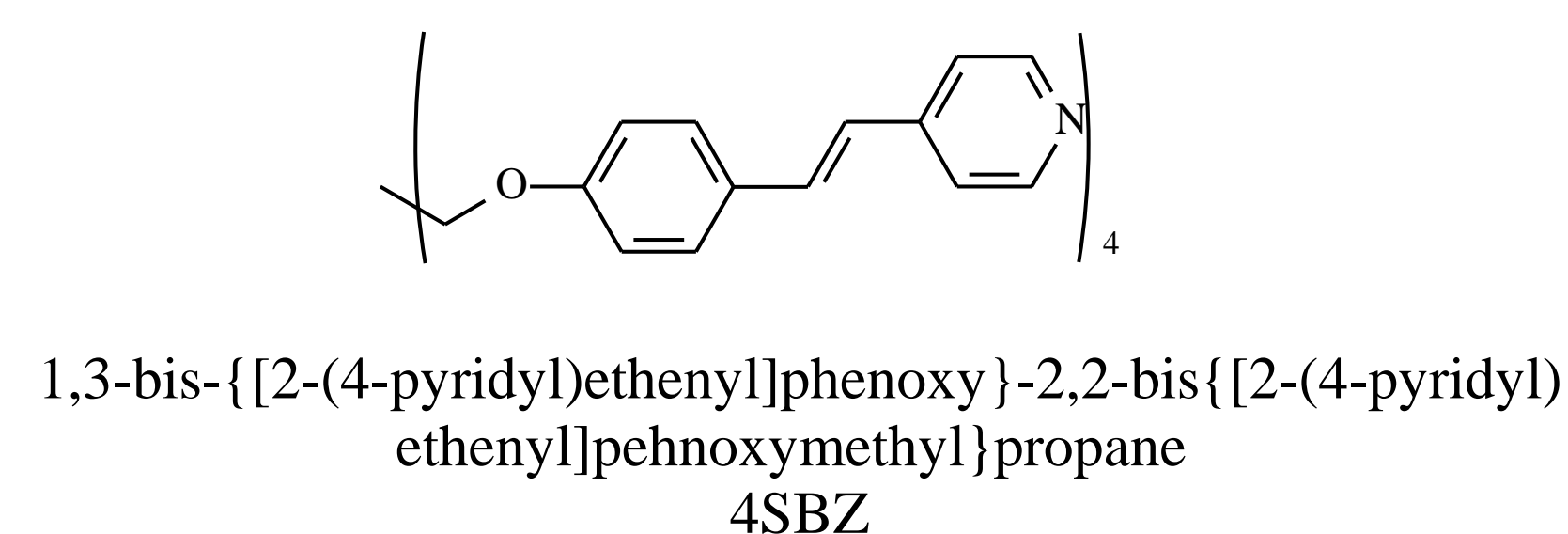
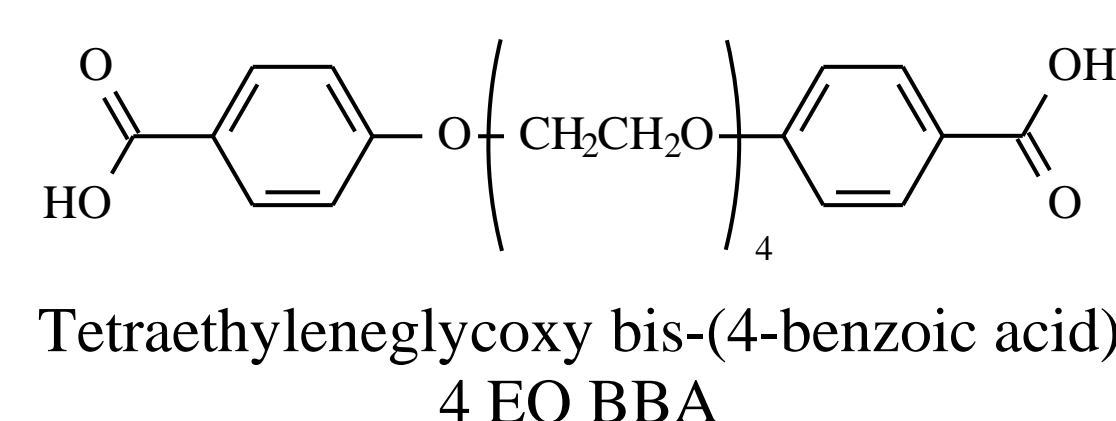


Mesogenic Networks

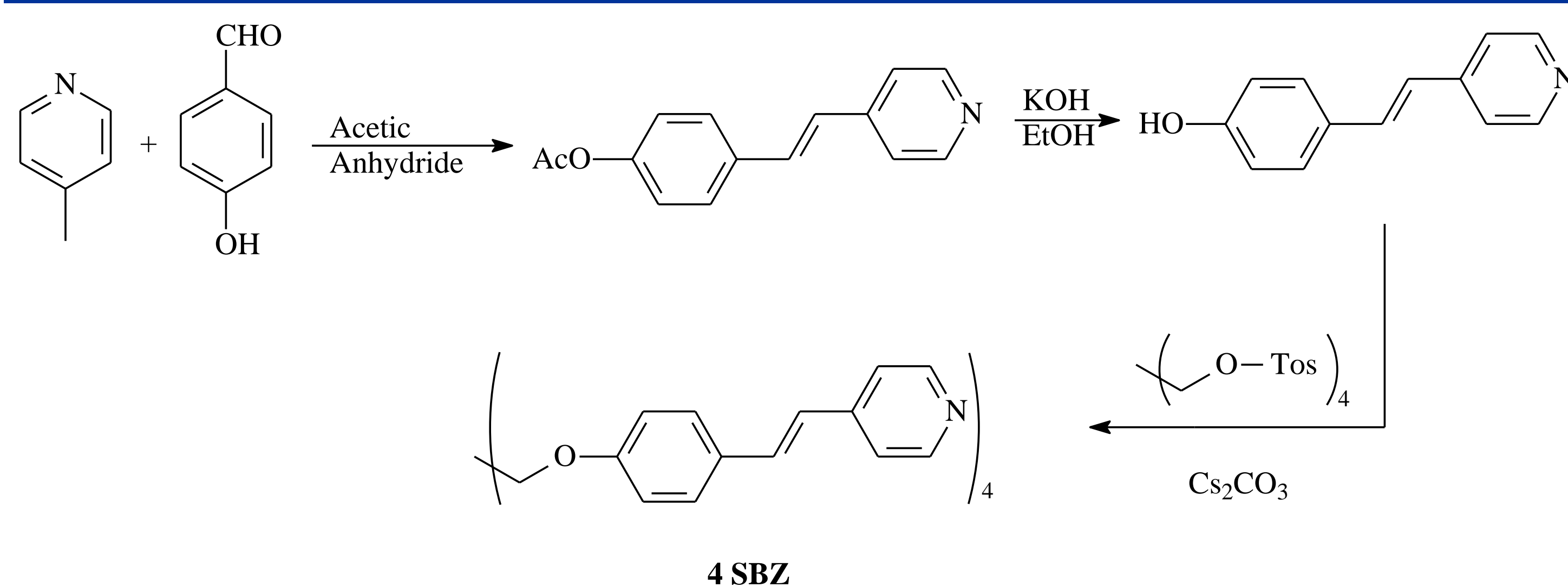
- Combine characteristic of networks and liquid crystals
- Couple physical deformations with liquid crystalline phase behavior
- Thermoreversibility through hydrogen bonding would introduce lability and the ability to reorganize to these characteristics



Materials Used



Synthetic methodologies



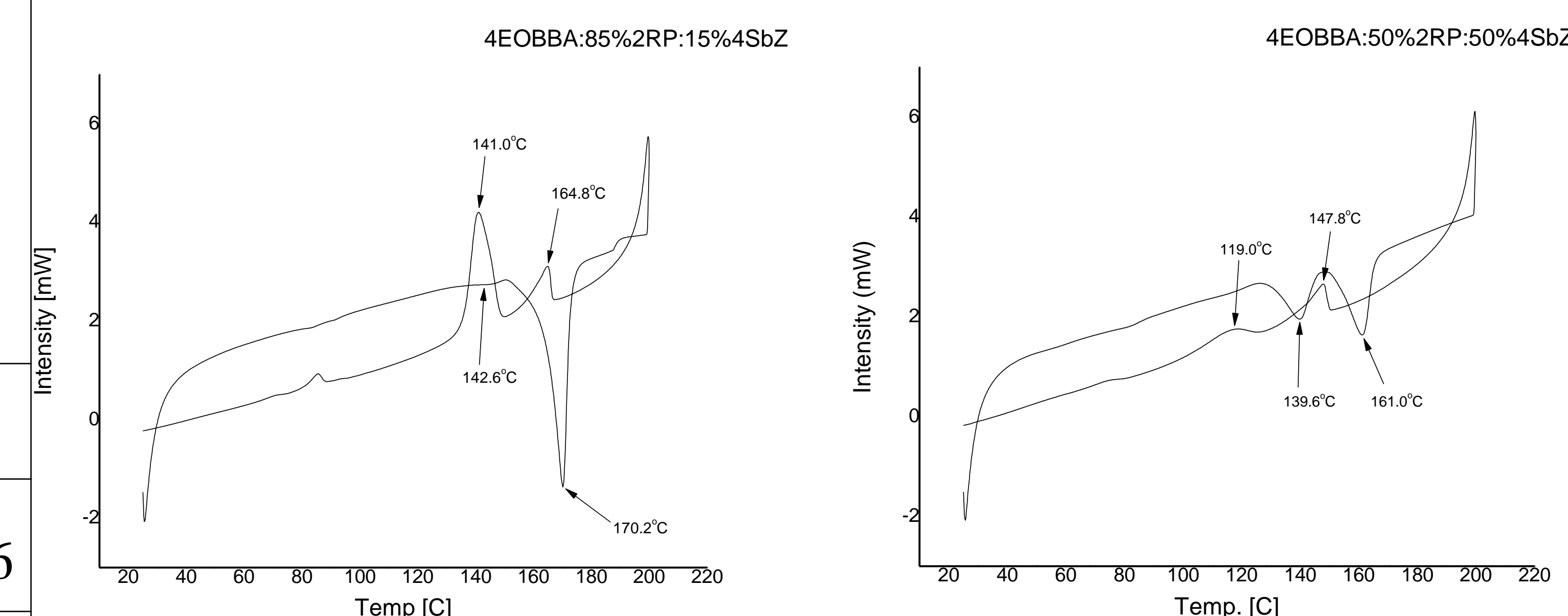
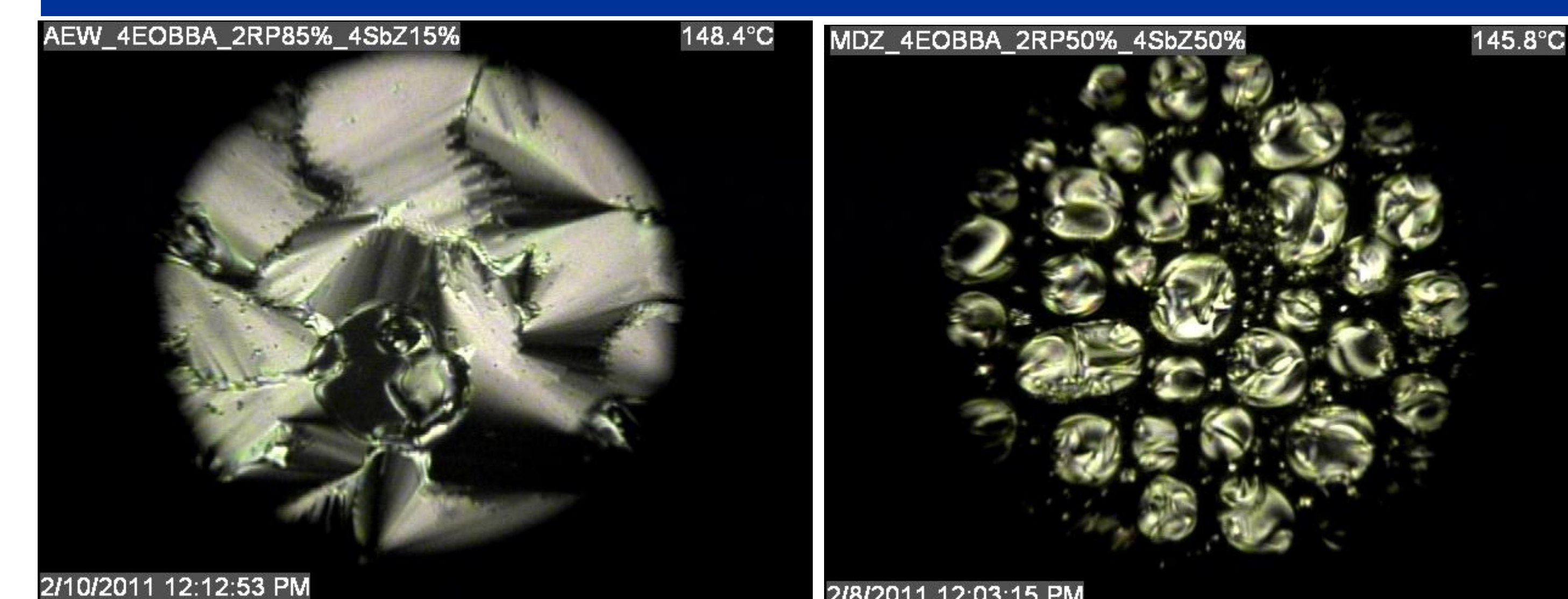
Thermal Analysis

- Complexes synthesized through standard melt-complex methodology
- DSC data determined on a Mettler-Toledo STAR e1 DSC at 10°C/Min heating rate unless otherwise noted
- Optical micrographs were measured using a Mettler-Toledo FP82 Hotstage Mounted on an Olympus BHT polarizing light microscope at a 10°C/Min heating rate unless otherwise noted

4EOBBA/2RP/4SBZ Networks Thermal Data

Trans (C) %	KI	KN	NI	IN	NK	IK	NS	SK
0	183.8			157.8	125.4			
5	170.5			171.4			160.1	144.6
10	167.8			161.1	139.9		**	
15		144.4	170.1	165.1	141.2			
20		147.8	169.5	163.5	140.6			
25		148.3	169.4	161.3	138.0			
30		143.5	166.2	156.4	133.1			
35		144.5	166.5	154.7	130.9			
40		140.1	164.5	152.6	123.2			
45		138.5	162.0	150.7	120.1			
50		140.1	161.5	147.9	117.8			
55		146.8	169.2	139.3	124.9			
60		145.5	159.8	143.5	Vit			
62.5		138	153.2	141.6	Vit			
65	143.3					135.9		
100	153.5					122.7		

4EOBBA/2RP/4SBZ Networks Thermal Data



Results/Observations

- 4SBZ/4EOBBA is non-liquid crystalline
- Networks formed provide LC phases in concentrations up to 62.5% inclusion
- Analogous tetrafunctional crosslinking groups with smaller pyridyl groups (4PD) eliminate mesogenicity at 25% inclusion
- The increased rigidity of the crosslinking agent may be allowing for mesogenicity to remain at high concentrations of disruptor
- 4SBZ has a higher melting point than 4PD (231 °C vs 198 °C) which may be allowing for higher clearing transitions/.

Conclusions

- The rigidity of the crosslinking agent is likely playing a role in the high clearing composition
- Further work will be to synthesize bis- and tris- stilbazole-containing agents

Acknowledgements

This work was funded by the Petroleum Research Foundation (54134-B7), National Science Foundation (Award Number 0804428) and UW-EC Office of Research and Sponsored Programs.