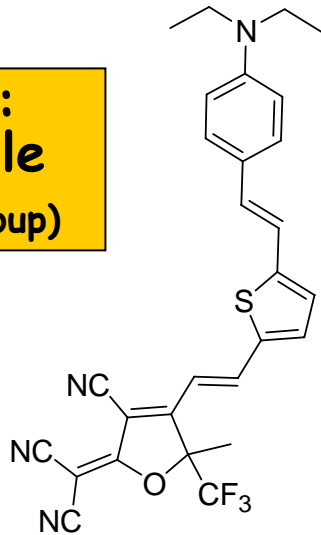


Stabilization of Photonic and Optoelectronic Polymers via Nanorheological Engineering

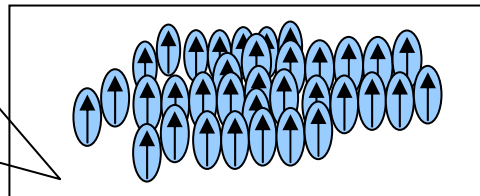
Tomoko Gray, IGERT 2003-2004, 2004-2005, Dept of Chemical Engineering

Polymer Based-Electronics: Electro-optical Switches

Chromophore:
molecular dipole
CLD type (Dalton group)



As a group, when they are aligned, it has dipole moment (charge separation)



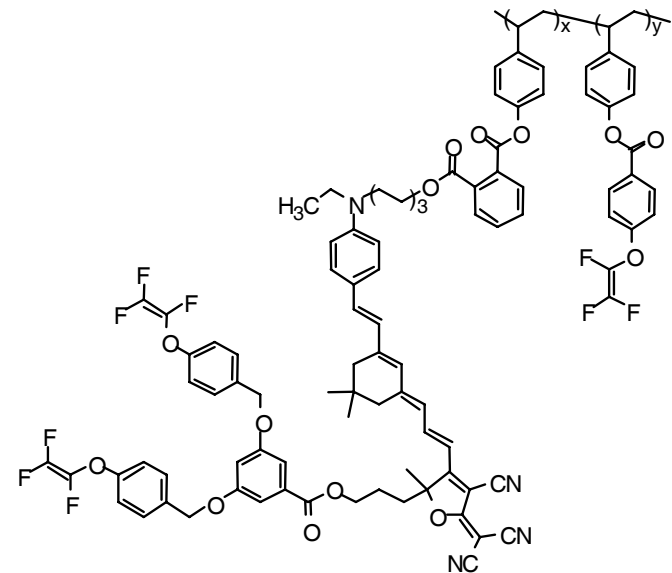
More electrons

Less electrons

Chromophore as a part of a macromolecule:

Mechanical Stability

PS-CLD1 (Jen group)

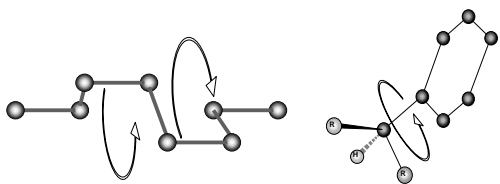


Scanning Probe Microscope (SPM): Nanorheological Characterization

Find

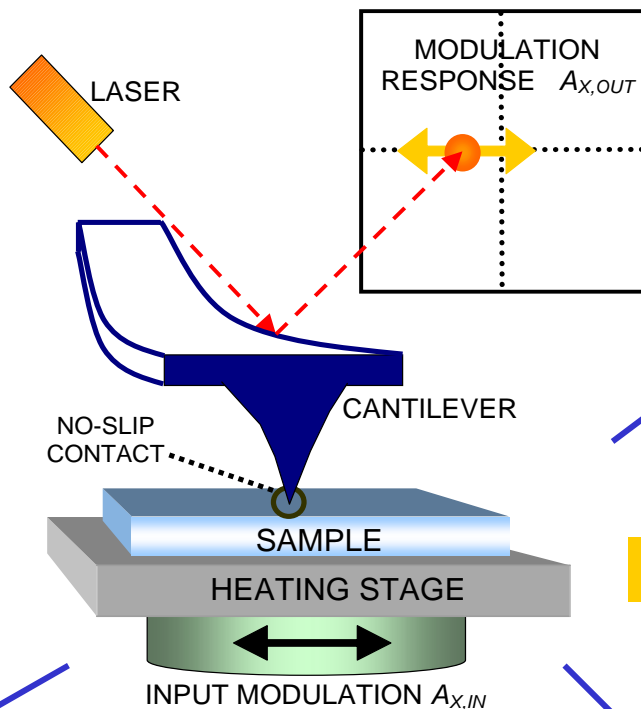
- How are molecules oriented ?
- How mobile are molecules ?
- How do molecular orientation and mobility affect on the device performance ?

Energy that associate with a particular Motion (Lateral Force Analysis)

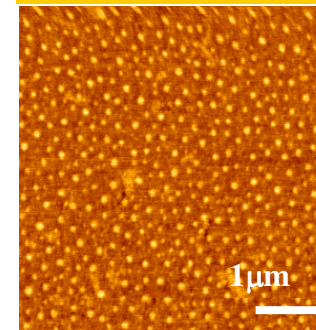


Backbone motion ~90 Kcal/mol, phenyl rotation ~7Kcal/mol

In Polystyrene

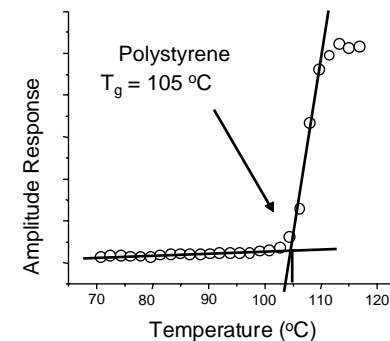


Morphology



Poly(9,9-dioctylfluorene) and Polystyrene blend system

Phase Transition Temperature



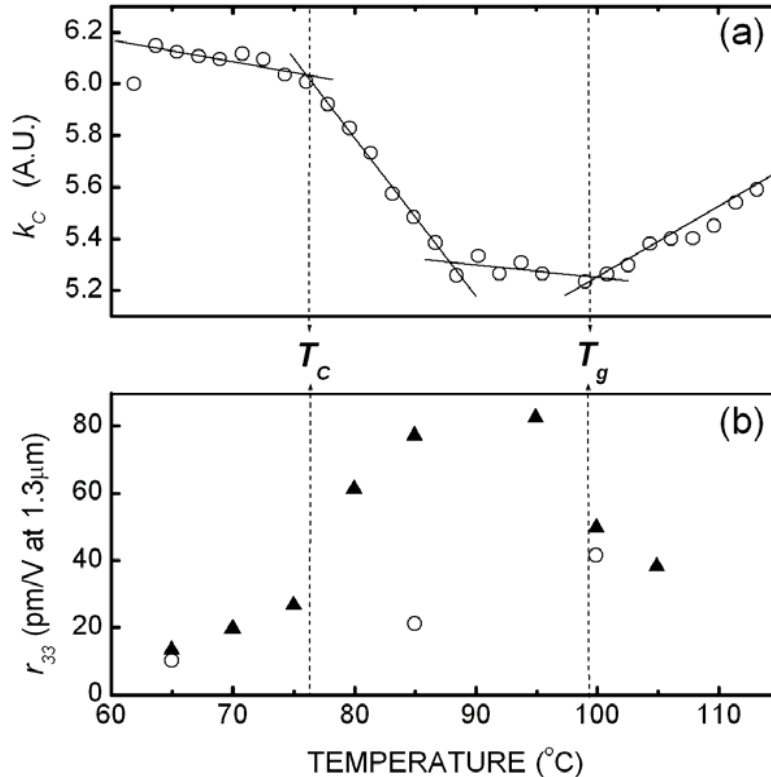
A certain motion is possible at (above) a certain phase: Glass transition temperature (T_g) is particularly important for polymers



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Low Temperature Phase Transition and Effective Chromophore Alignment



Phase Transition Result

Low Temperature Phase Transition:
Gaining local mobility of a molecular segment

Chromophore Alignment Result

Chromophores are mobile above the low temperature phase transition

- **Find which segment gain mobility at this low transition temperature - Lateral Force Analysis**
- **Development of a new technique that combine these techniques and more.**

