Advanced Resist Program

Carter Research Group
University of Massachusetts
Novel Imprint Resist Compositions

**MATERIALS ISSUES ARE KEY TO SUCCESS:**

- Photopolymer / Resist compositions
  - speed, stability and ability to mold small features
  - New materials chemistry developed – synthetic expertise
  - Etch resistance
- New thermally imprint resists
  - reversible crosslinking systems
  - completely new chemistries explored
  - non-siloxane based, highly etch resistant polymers
- Photopolymerization kinetics in ultra-thin films is relatively unknown
- Need to explore limit of resolution
- Limit residual layer thickness
- What happens as feature sizes approach the size of macromolecules?
**Organized Self-Assembled Block Copolymers**

* Block copolymers can self-assemble into unique nanostructures

**Grand challenges**

- **Control and direct polymer self assembly**
- What are the general principles involved?
  - Synthesize functional materials with controlled self-assembly
  - Can we design novel sequences?
Organized Self-Assembled Block Copolymers

**Observed Behavior:**
Good short range order (microns) then dislocations disrupt long range order

**Boundary Induced Order:**
Design in boundaries or steps by predetermined lithography to direct long-range ordering
Resists for Nanolithography Summary

PROJECT STUDY AREAS

1. Photopolymerization
   • Study photopolymerization of thin films both in-contact and free standing

2. Thermal Imprint Process and Materials

3. Interface Control
   • Study adhesion at interfaces (substrate/photopolymer) and release layers (master/mold & mold/replica)

4. Molding of Nanostructures
   • Explore the complexity of structures possible and improve process

5. Self-Assembled Block Copolymer Patterning

EQUIPMENT & RESOURCES

- Custom-built imprinter with optical and thermal capabilities
- Commercial imprint equipment
- Full synthetic laboratory and wafer processing
- World-class characterization facilities
- Nanoimprint laboratory and cleanroom
- Industrial partners and collaborations (academic, National Labs, etc.)