

CHE323/CHE384
Chemical Processes for Micro- and Nanofabrication
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Lecture 63
Nanoimprint Lithography,
part 1

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Nanoimprint History

- Embossing has been around for centuries
 - a process for producing raised or sunken designs or relief in a substrate using a relief template

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Nanoimprint History

- Hi-tech embossing includes the manufacture of CDs, DVDs, and Blu-ray discs

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Nanoimprint Lithography

- Types of nanoimprint lithography (NIL)
 - Thermal imprint
 - Step and flash (jet and flash: J-FIL)
 - Roll-to-roll
 - Other types of “soft lithography”
- Advantages of Imprint Lithography
 - Relatively inexpensive
 - Easy to get high resolution
 - Can be used for mass production

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Thermal Imprint

S. Chou (Princeton) Nanonex

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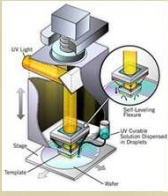
Step-and-Flash

Grant Wilson, UT Austin

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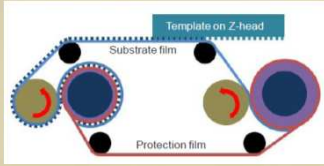
Step-and-Flash NIL (vs. Thermal Imprint)

- Room temperature
 - heating makes precise overlay virtually impossible
- Faster
 - no significant pressure required
 - UV exposure is very fast
- Longer template lifetime
- Variation: Jet-and-Flash (J-FIL)
 - Use an inkjet head to dispense the resist in the right quantity depending on pattern density

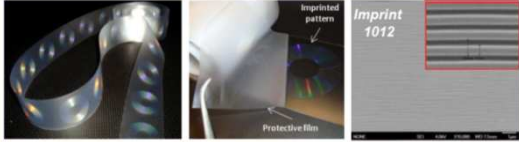


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Roll-to-Roll Imprint



50 nm features

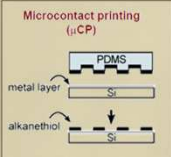


From Molecular Imprints

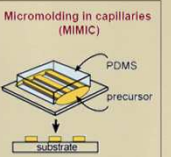
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Other Soft Lithography Techniques

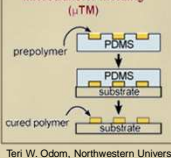
PDMS = poly(dimethylsiloxane)
Mostly micron-sized features



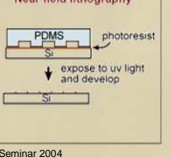
Microcontact printing (μCP)



Micromolding in capillaries (MIMIC)



Microtransfer molding (μTM)



Near field lithography

© Chris Mack Teri W. Odom, Northwestern University Seminar 2004 9

Lecture 63: What have we Learned?

- What is “soft lithography”?
- Name three types of nanoimprint lithography
- What are the advantages of imprint lithography?
- What are the main advantages of Step-and-Flash imprint over thermal imprint?

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