To Predict ▶ To Design ▶ To Perform

College of Engineering
Department of Mechanical & Industrial Engineering

ME, ECE, BE Capstone Design Programs

Team #38 A Roll-To-Roll Nanoimprint Lithography Device

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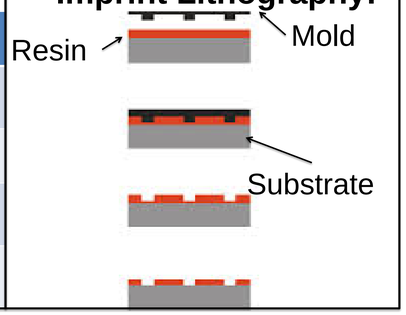
Background:
Nanoimprint lithography is a fast throughput, accurate way to imprint nano and micro structures on a variety of membranes

Objectives:
- Design a Roll-To-Roll Imprint lithography device that is small and continuous
- Achieve a micropattern with recognizable patterns of 10 micrometers
- Allow for either thermal or ultraviolet curing

Engineering Specifications:

Specification	Target Value
Minimum Nanostructure Size	> 100 µm
Transverse Speed	< 1 in/s
Types of Lithography	Thermal
Consistency of Coating	+/- 1 µm

Imprint Lithography:



Safety:
- External components exposed to the user will remain at a temperature of less than 120ºF
- Acrylic case will keep device dust-free, while keeping operators at a safe distance
- Taped sections will indicate danger zones where pinch points, or heated areas are present

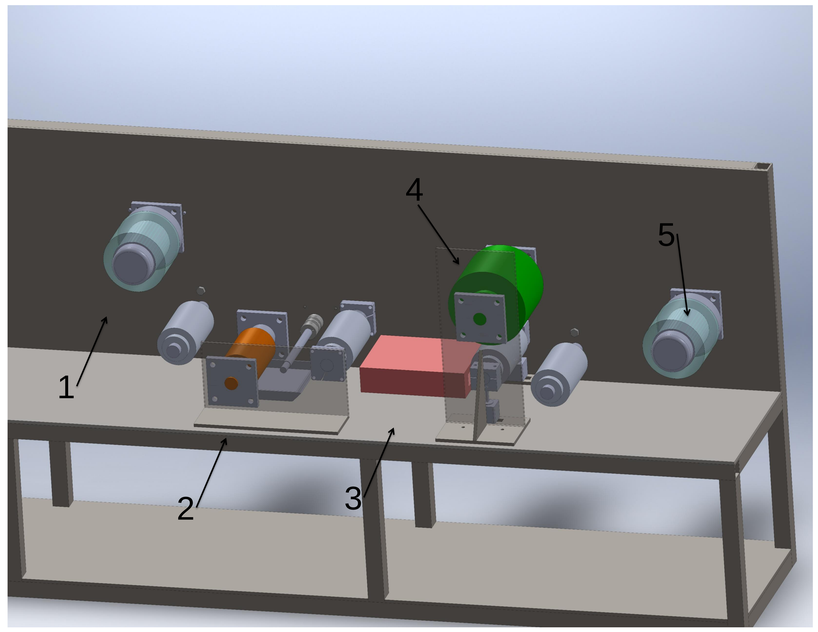
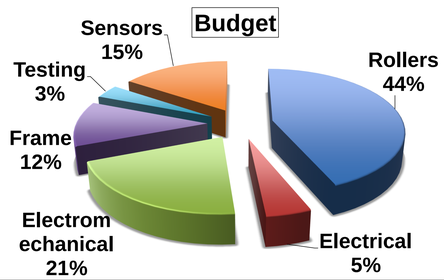


Figure 1: Roll-To-Roll compact imprint lithography prototype

- 1.) Unwind
- 2.) Application
- 3.)Baking
- 4.) Mold
- 5.) Rewind



Testing:
To verify the system operates within the specifications, the device will be tested with a range of microstructures at multiple transverse speeds and pressures.

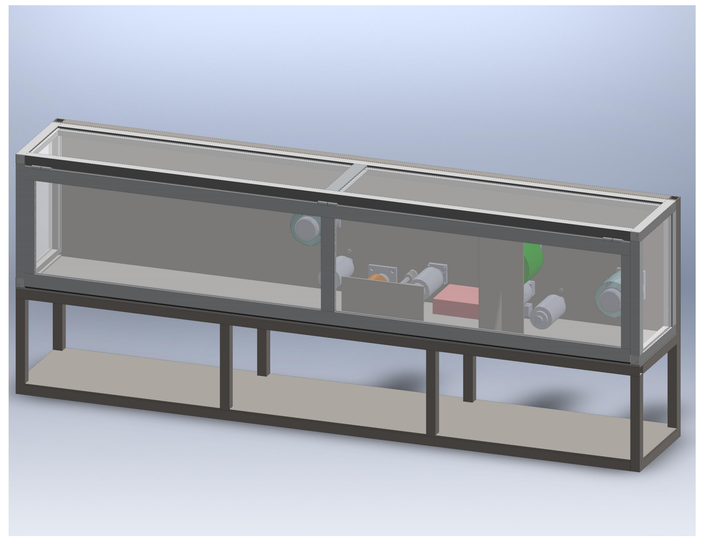


Figure 2: Covered prototype

Control System:
- Controlled by two Arduino microcontrollers with motor shields
- Arduino sketches are interfaced with LabVIEW
- Temperature, tension, force, and speed are adjustable via LabVIEW
- Instruments powered 12/24V DC and 115 V AC

Analysis:
- Designed to minimize vibration worth high quality bearings, shaft accuracy, and ridged design to enhance the resolution
- Estimated 47 seconds required to prebake at a temperature of 150 ºC

Sponsor: Sunggook Park

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