FABRICATION OF 3-DIMENSIONAL CROSS BAR CIRCUITS BY NANOIMPRINT LITHOGRAPHY

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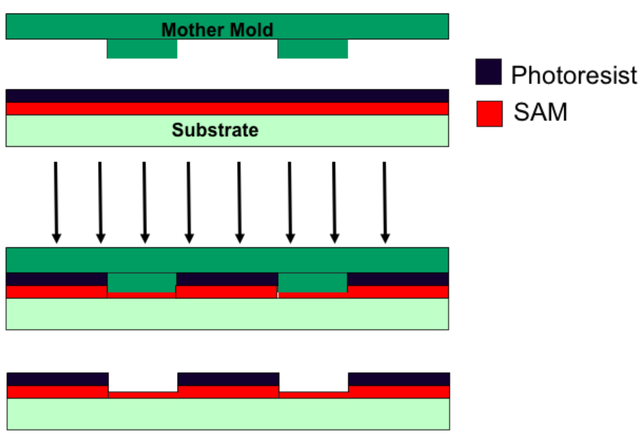
Abstract

In this research project, we will use the nanotransport printing process to fabricate three-dimensional crossbar circuits by applying two layers of conductive polymers on a substrate. We use NIL to fabricate a poly[(mercaptopropyl)methylsiloxane] (PMMS) mold and press it to the substrate. The sample is exposed to UV irradiation followed by detaching the mold and substrate. To fabricate cross bar structures, the substrate but must rotated 90° every time before adding a new layer of patterns.

Introduction

Nanoimprint lithography (NIL) is a direct contact-method for transferring a pattern to a substrate. By using NIL, the pattern structures from a mother mold are transferred to a substrate that was spin-coated with a UV resist layer, where the pattern structure will be stored. The sample is cured with ultraviolet irradiation and then detached apart.



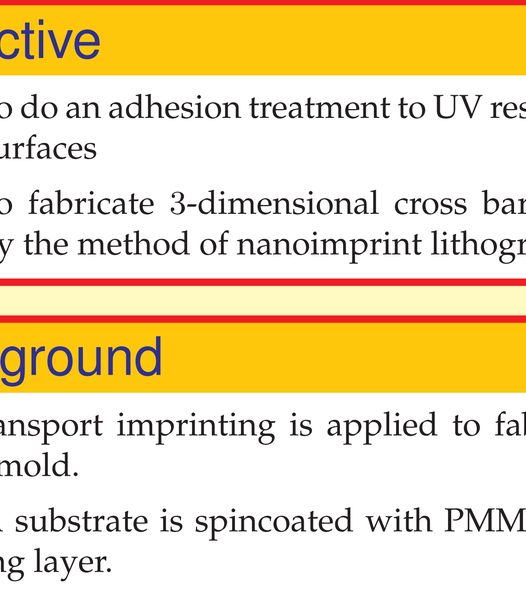
Objective

- To do an adhesion treatment to UV resist mold surfaces
- To fabricate 3-dimensional cross bar circuits by the method of nanoimprint lithography

Background

Nanotransport imprinting is applied to fabricate a PMMS mold.

1. A substrate is spincoated with PMMS releasing layer.
2. The substrate with PMMS is pressed onto the UV resist mold followed by curing the sample with UV irradiation.
3. The detached substrate with PMMS releasing layer becomes the PMMS mold



Conductive Polymers

MEH-PPV- poly(2-methoxy, 5 ethyl (2 hexyloxy) para-phenylene vinylene)

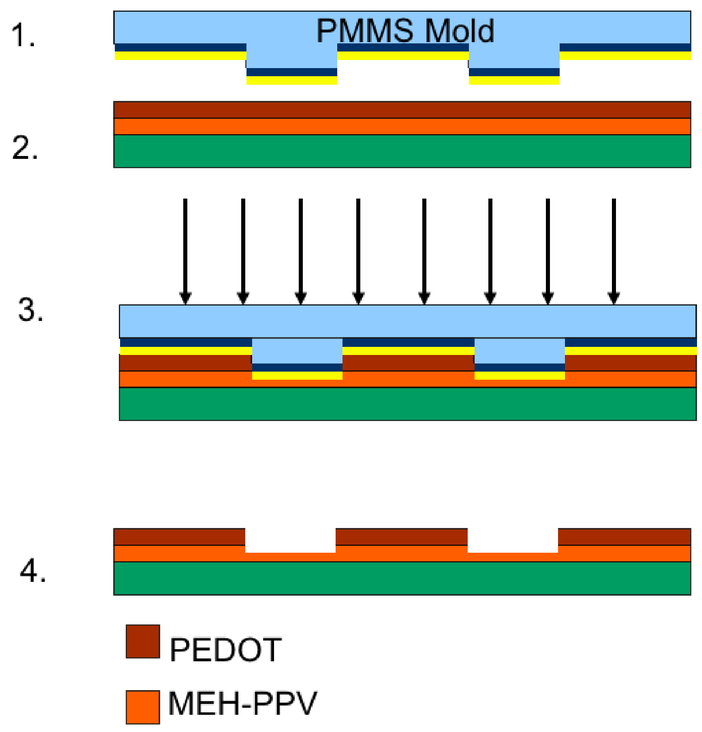
- Highly conductive fluorescent polymer
- Doping this polymer with iodide ions can change the polymer's conductivity from insulator like to metal like

PEDOT- Poly (3, 4-ethylenedioxythiophene)

- High conductivity, transparency & thermal stability
- Different charge and discharge cycles that can be electrogenerated on a conductive support

3-D Cross Bar Circuit

1. Apply a layer of surfactant followed by gold & titanium to the mold
2. Spincoat a substrate with MEH-PPV & PEDOT
3. The PMMS mold is pressed onto the substrate followed by UV irradiation
4. The detached substrate with MEH-PPV & PEDOT is a bar circuit.

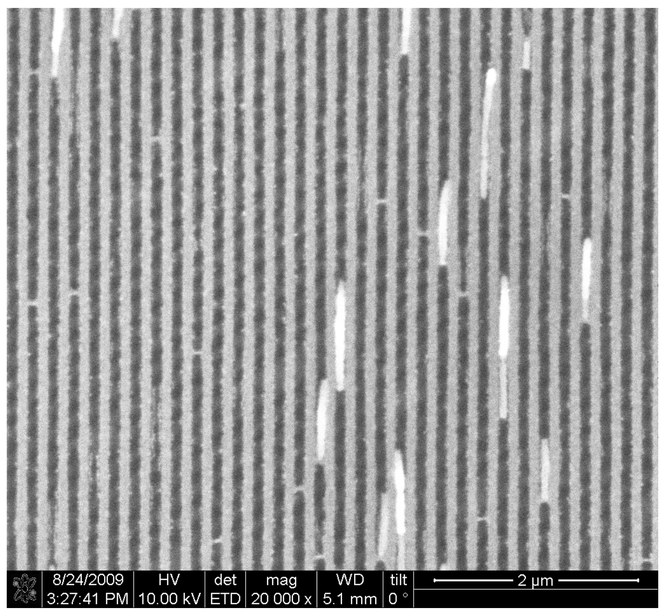


To make a 3-D cross bar circuit rotate the substrate ninety degrees every time before adding a new layer and follow the same procedures

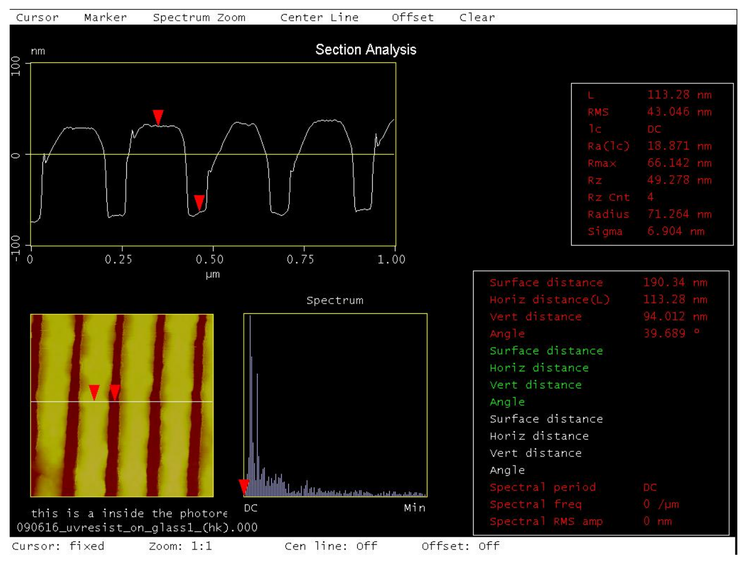
Problem

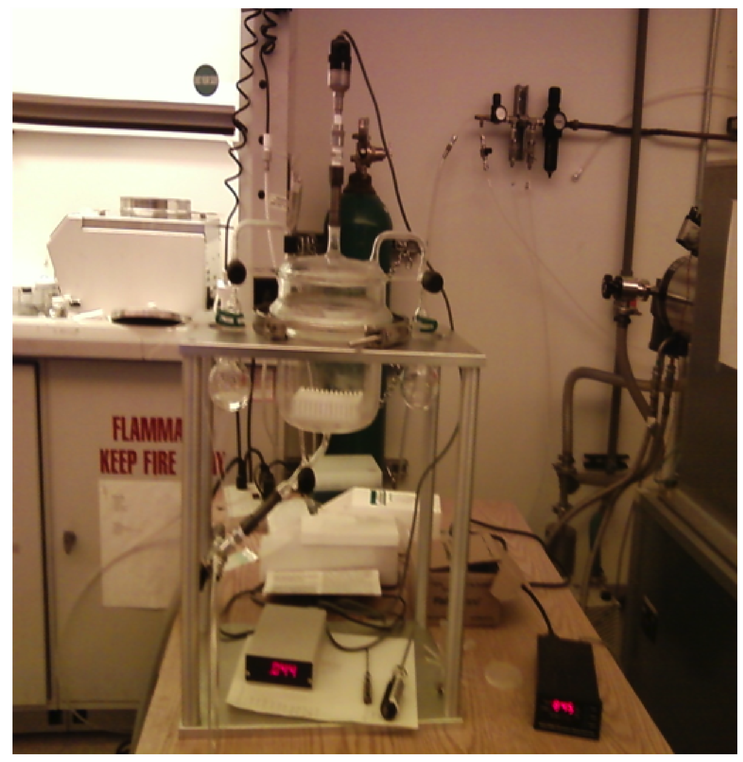
- High Defect Count
- High adhesion of mold to resist layer
- Low adhesion of resist layer to substrate
- Overlay

Results



Discussion & Conclusion





Conclusion

In this research project I contributed in the fabrication of three-dimensional cross bar circuits by doing adhesion treatment to the UV resist molds.

Much Thanks & Gratitude To

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References

[1] L. Jay. Guo Nanoimprint Lithography: Methods and Materials Requirements. In *Advanced Materials, 19:495-513, 2007*

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