



# A Multi-Material Milli-Robot Prototyping Process

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## Project Goals

The purpose of this research is to demonstrate the use of photo-patternable polymers of varying Young's Moduli to create multi-material centimeter and sub centimeter scale mobile robots

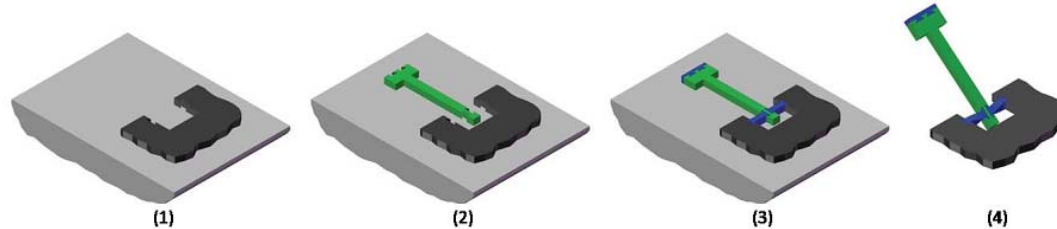
## Applications

- Improve efficacy, mobility and robustness
- Design robots on a benchtop instead of in a clean room
- Create compliant components for added robustness
- Reduce fabrication time

## Milli-Robot Prototyping Process

(1) Wipe substrate with PDMS to prevent adhesion and cure first rigid polymer on substrate

(2) Cure second rigid polymer (green)

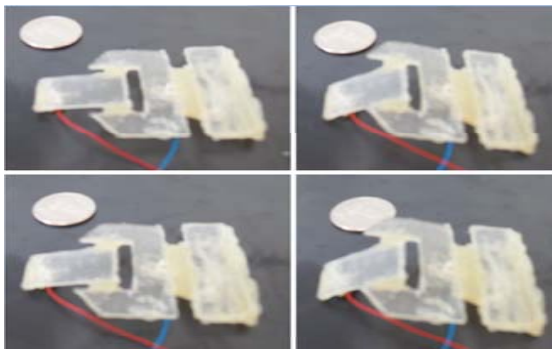


(3) Cure highly compliant polymer (blue)

(4) Peel structure from substrate

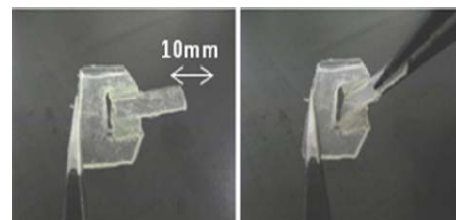
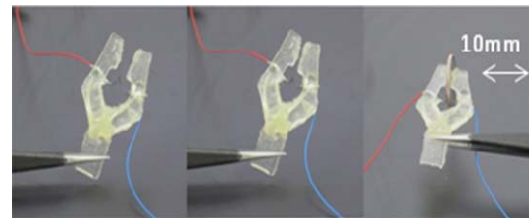
## Demonstrations

- Use Loctite UV curable polymers 3525 (acrylic) and 5084 (silicone)
- Integrate shape memory alloy for actuation



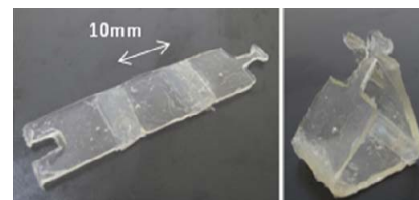
7.4 g inchworm robot walking forward. Each step size is 1.2 cm

Gripper actuation. In the last frame, the gripper holds a dime.



0.3g bi-material torsion hinge

Planar bi-material features can be fabricated, folded, and secured out-of-plane to build complex 3-D structures.



## Future Research

- Demonstrate process on a smaller scale
- Prototype robots that are fully autonomous
- Embed electrical components (e.g. controller)
- Integrate more efficient actuators
- Examine the durability of materials and bonds

