Micropatterned PDMS stamps for spatially selective dry transfer of exfoliated flakes

Charles Yang[1]

John Lyons[1]

Benjamin Hunt[1]

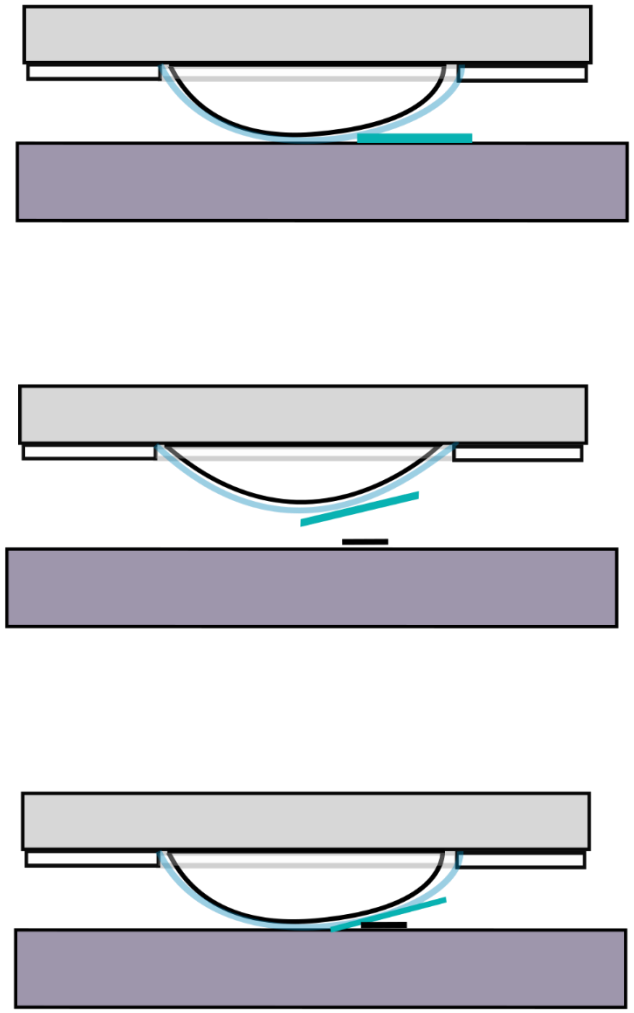
16 March 2022

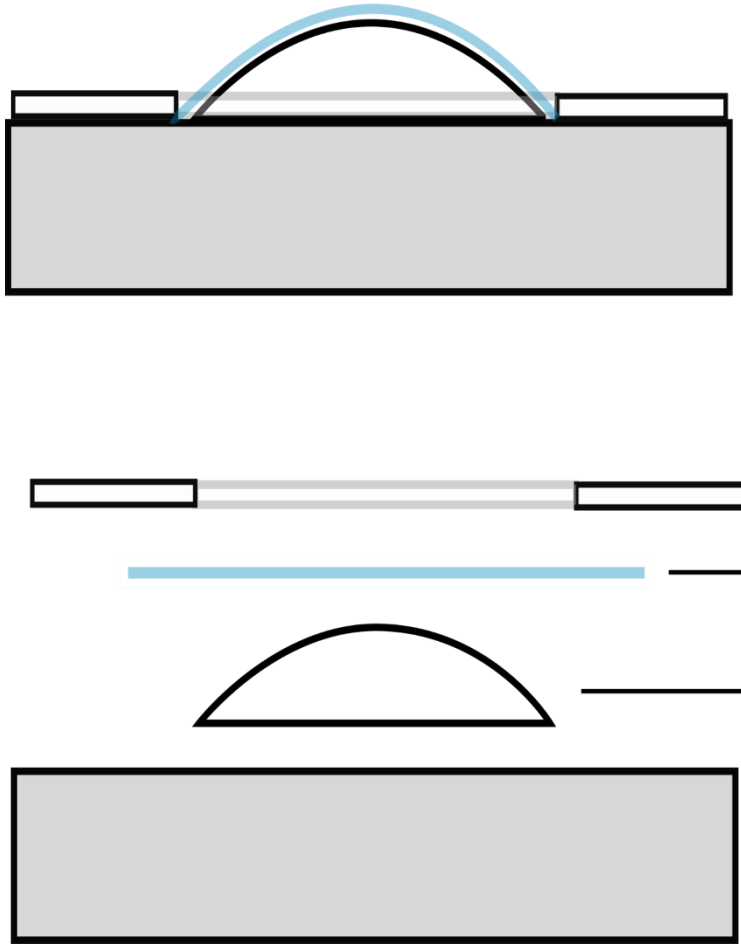
[1]Carnegie Mellon University

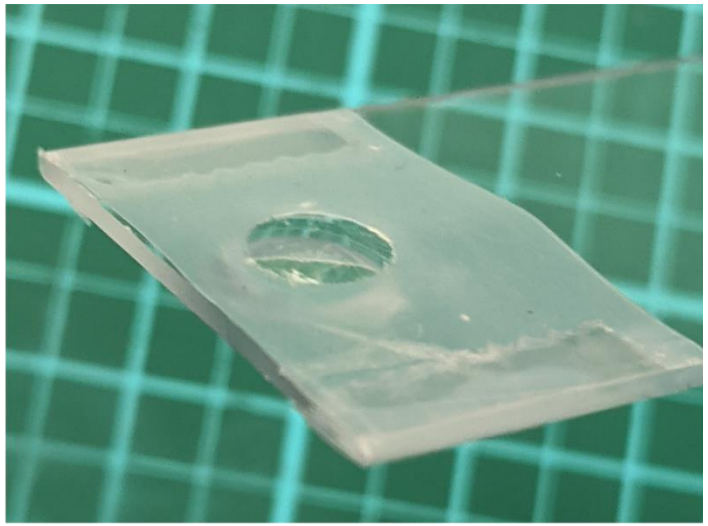
Outline

- Background and Motivation: Crowded flakes
- Solution and Implementation: SU-8 Molds
- Results: Promising improvements in spatial selectivity, visibility

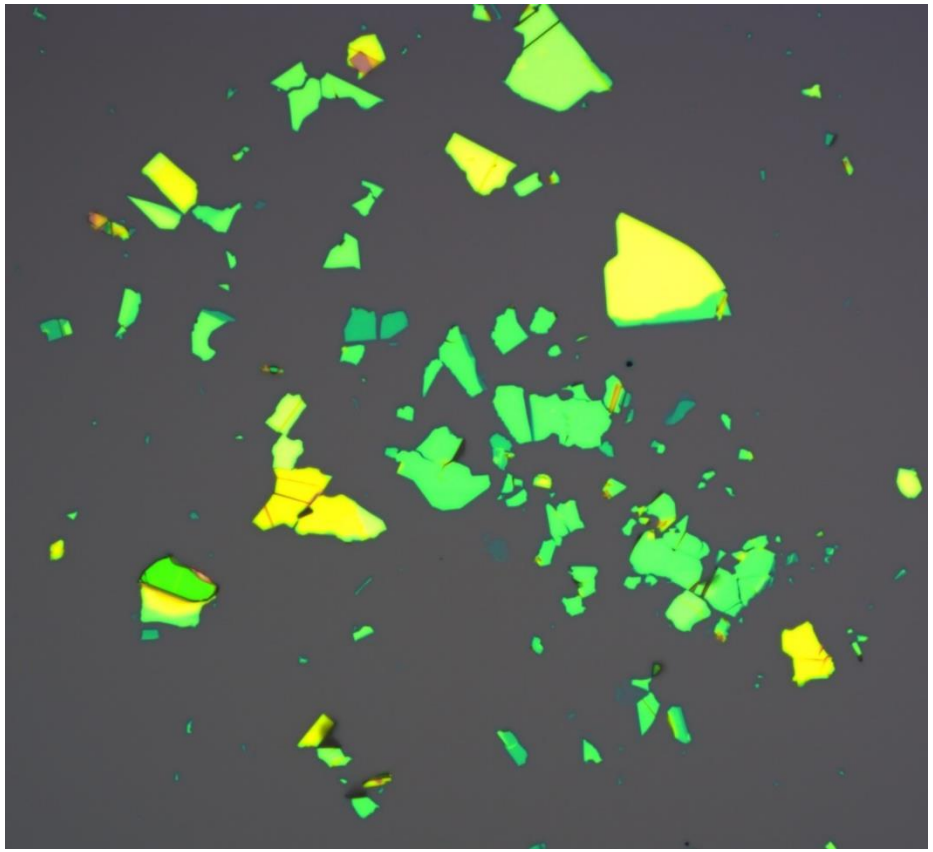
Traditional Transfer Slides



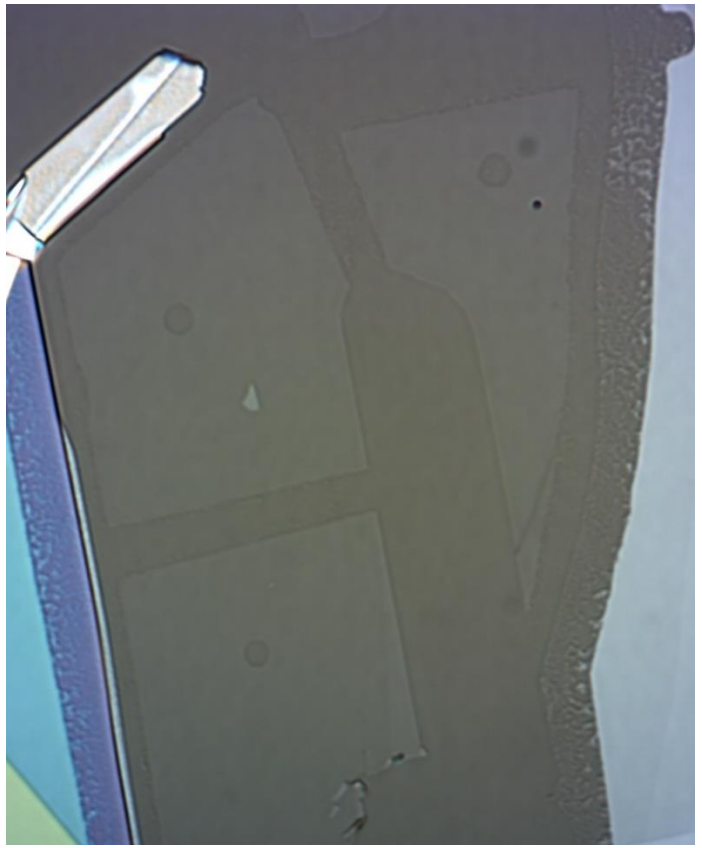




Motivation

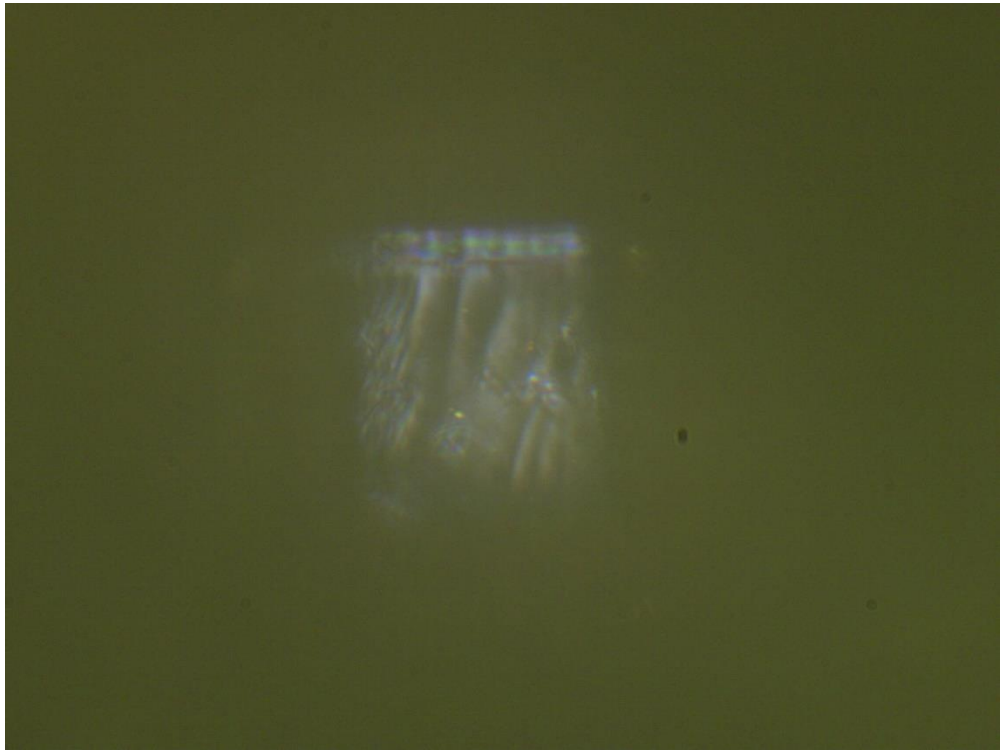


Desired flakes may be crowded…

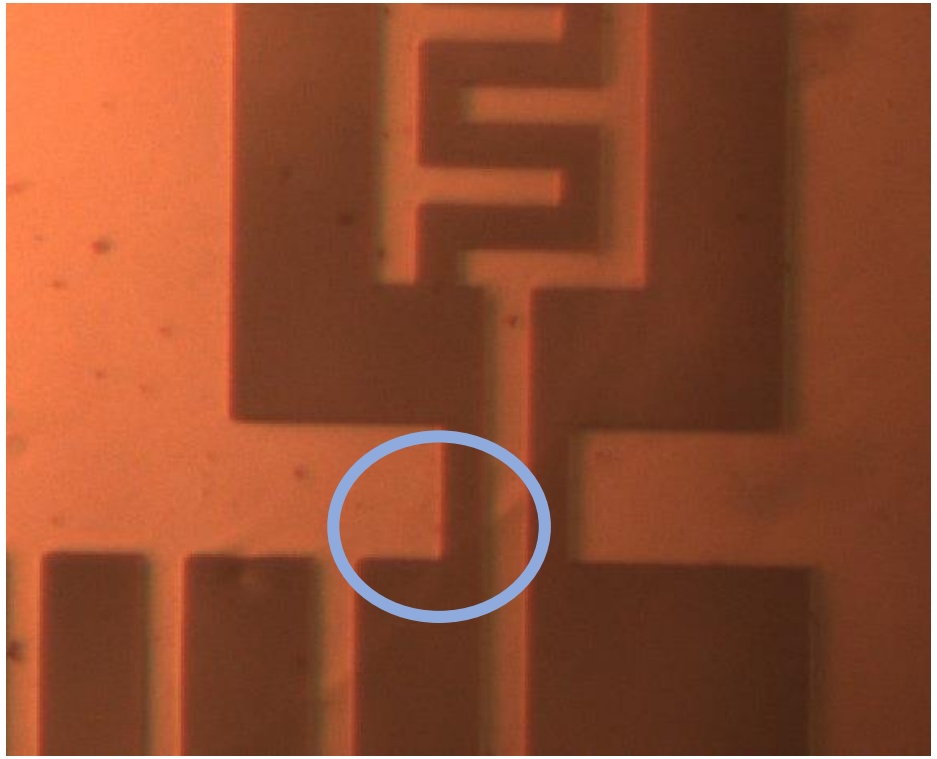


…or etched out of larger flakes

Motivation

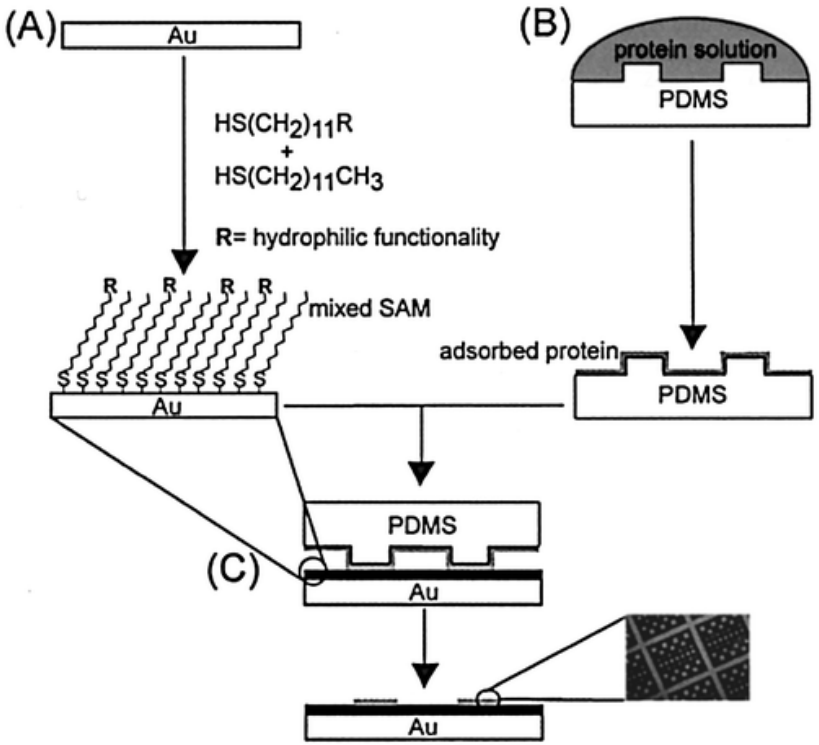


Hand-cut PDMS slabs are inconsistent, hard to see through, and is limited to about 70x70um



Droplets are difficult to align, curvature is not well controlled, the image is distorted

Inspiration



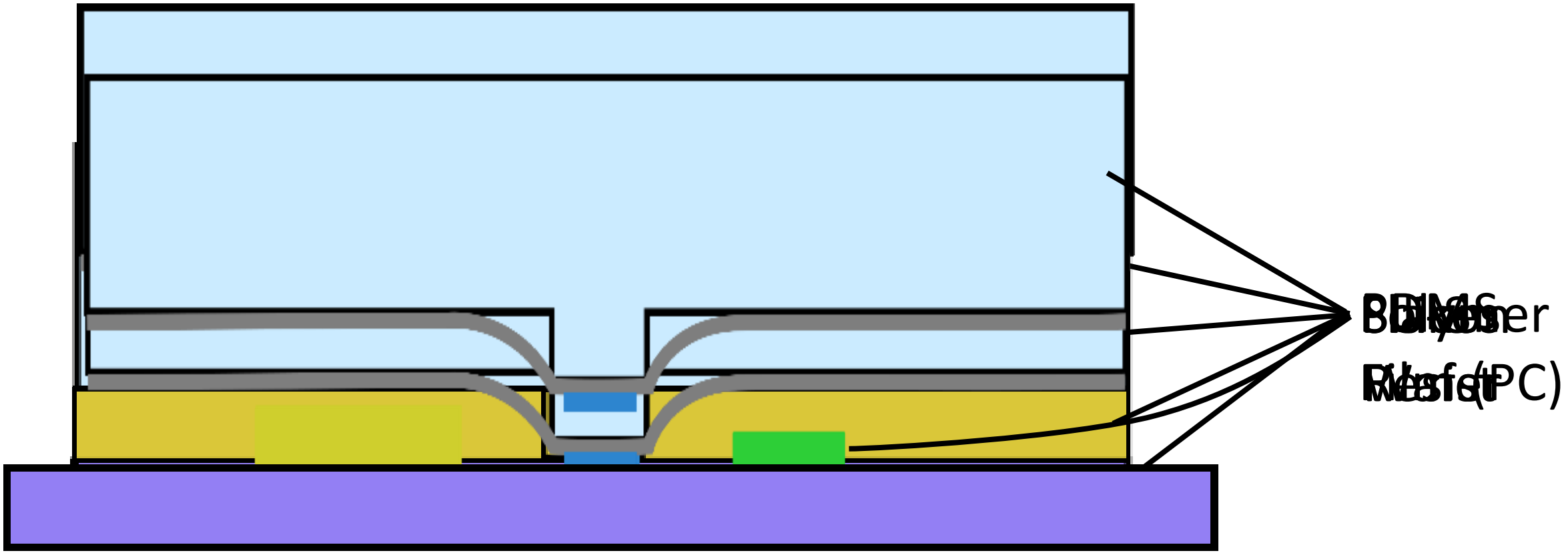
PDMS stamps for microcontact printing of proteins [1]

SU-8 molding of PDMS for microfluidic devices [2]

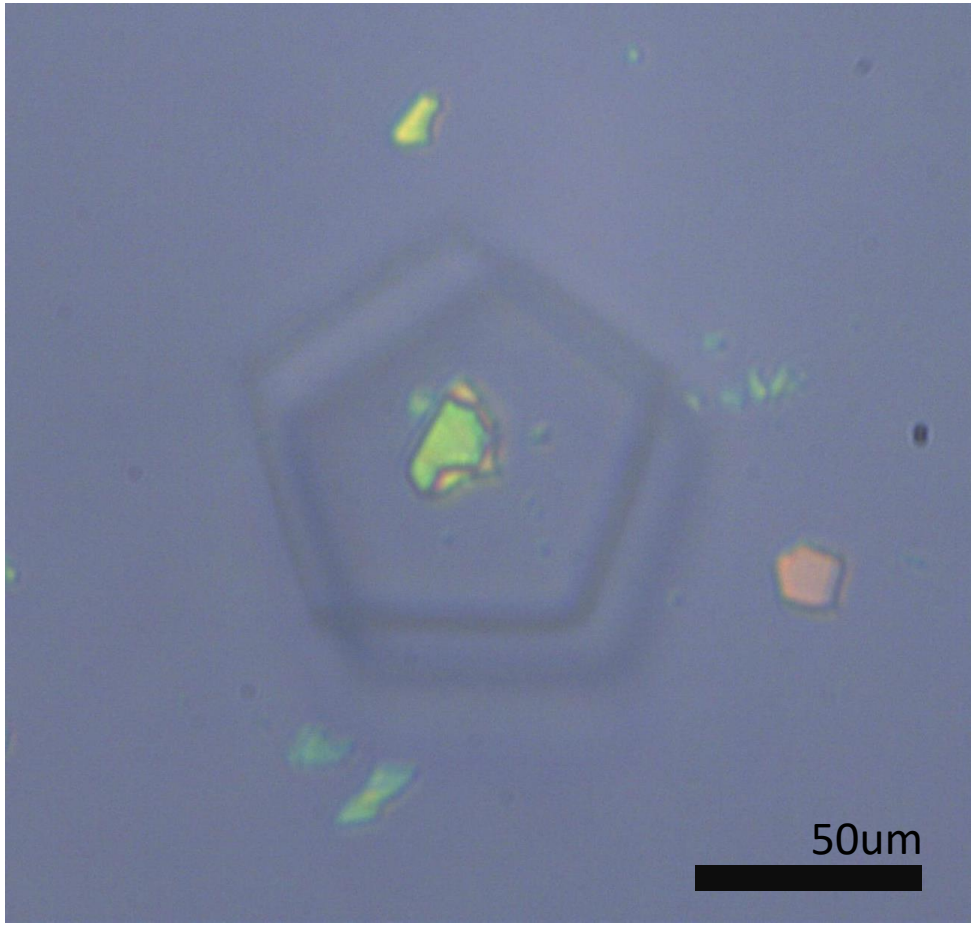
[1] *Langmuir* 2002, 18, 2, 519-523

[2] A. Ayoib, U. Hashim, M. K. M. Arshad and V. Thivina, *2016 IEEE EMBS Conference on Biomedical Engineering and Sciences (IECBES)*, 2016, pp. 226-229

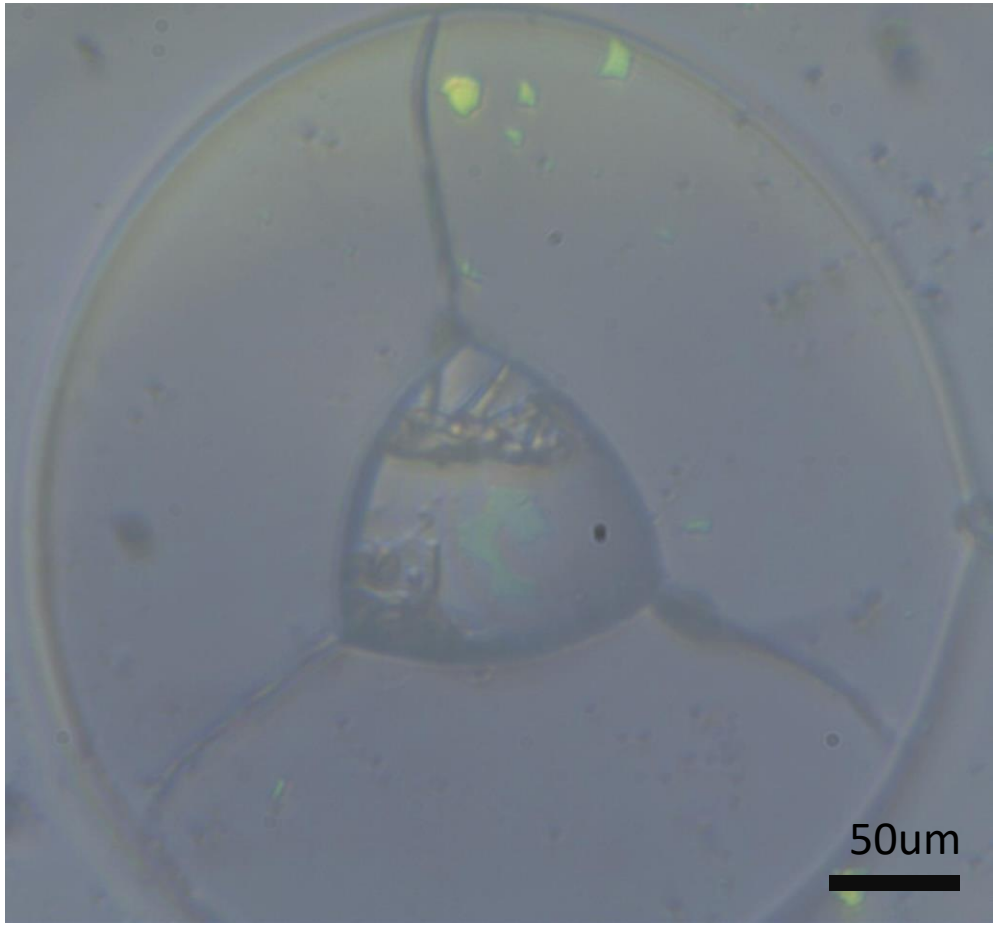
Micropatterned PDMS Transfer Slides



Advantages: Visibility and alignment

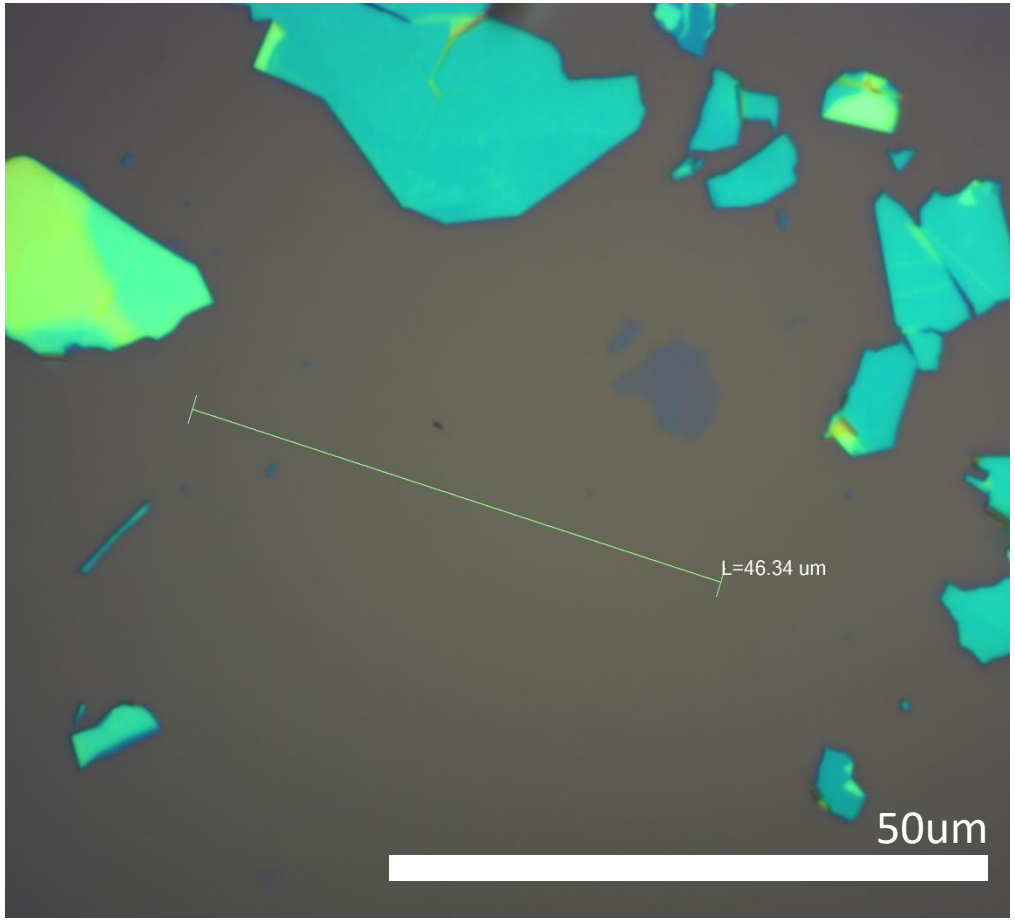


Pentagonal spike without film aligned over thick hBN

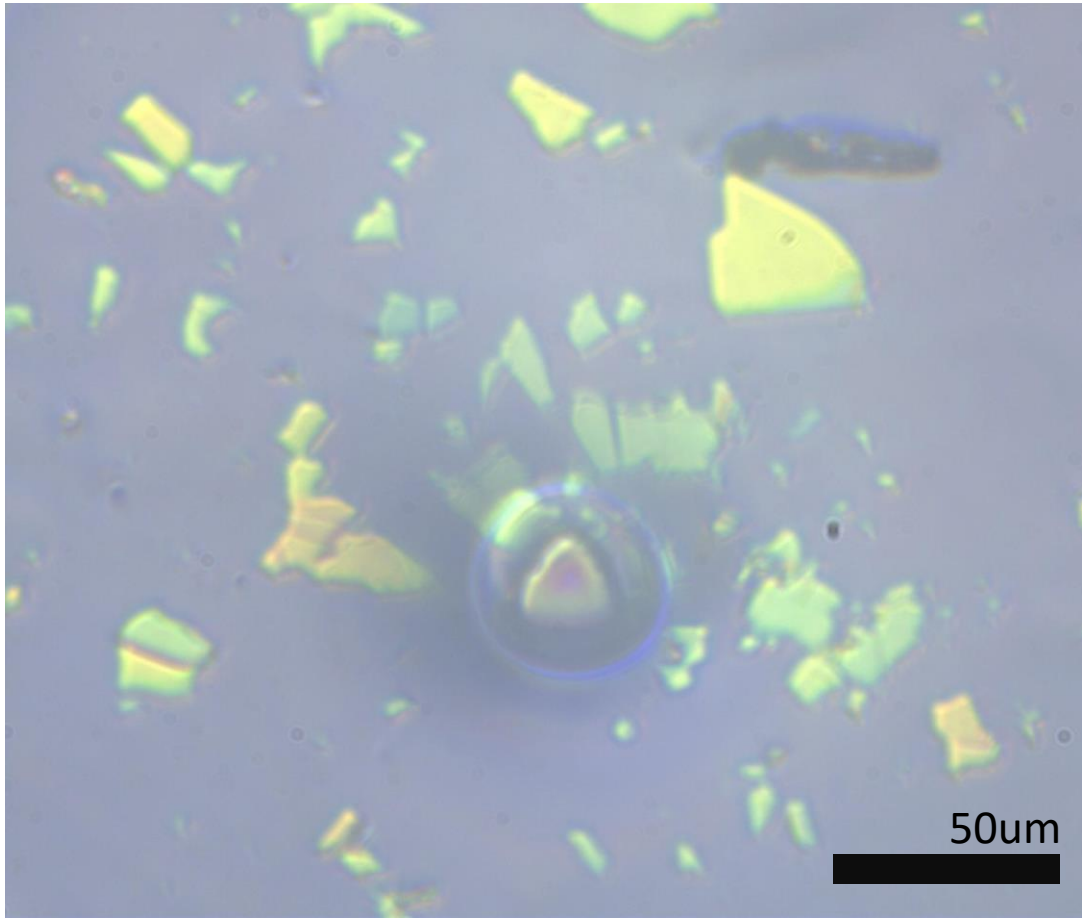


Rounded triangular spike with PC film aligned over thin hBN, made from a reused mold

Advantages: Spatial Selectivity



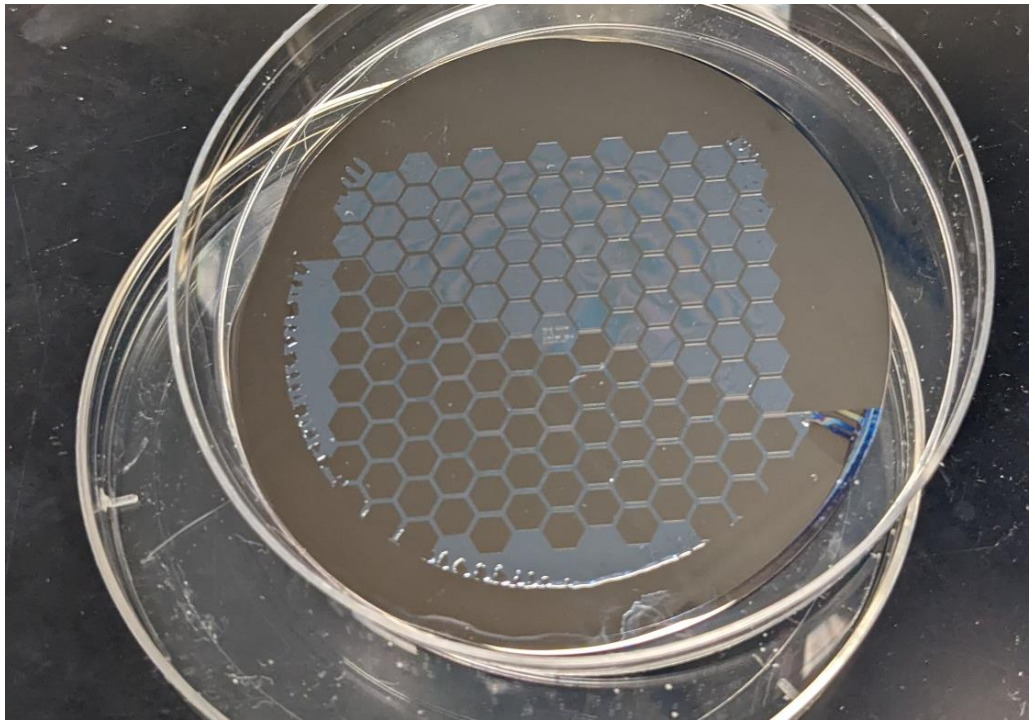
Picture taken at 100x



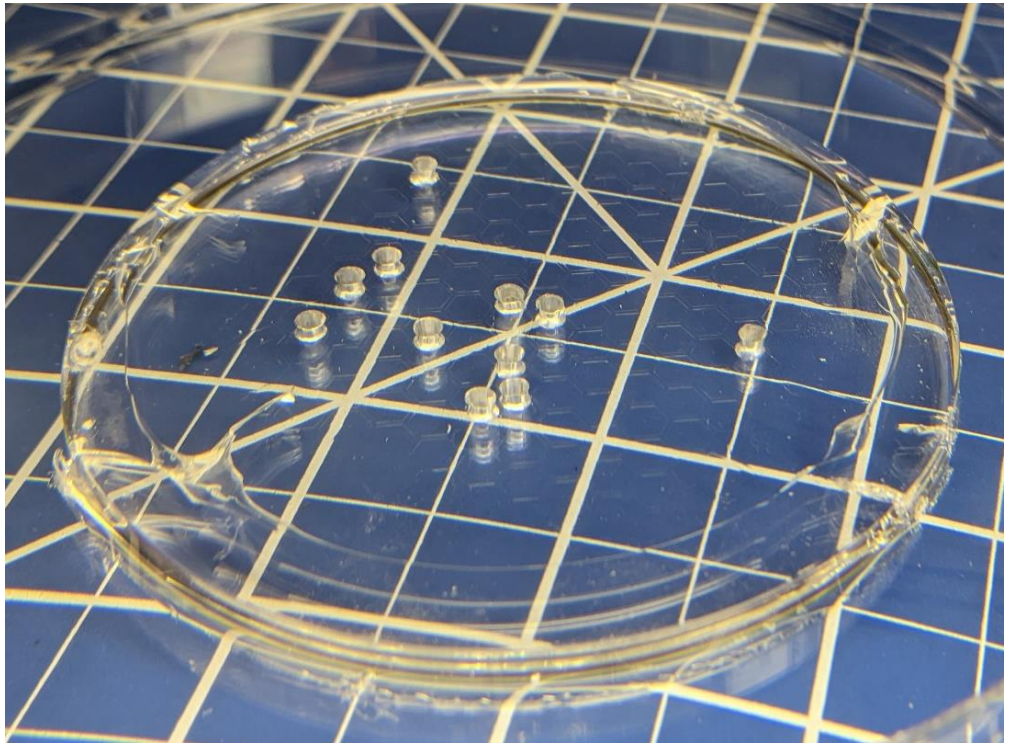
Picture taken through transfer slide at 10x

Advantages: Ease of Production

- Patterning molds takes ~1.5 hours
- Molds are reusable

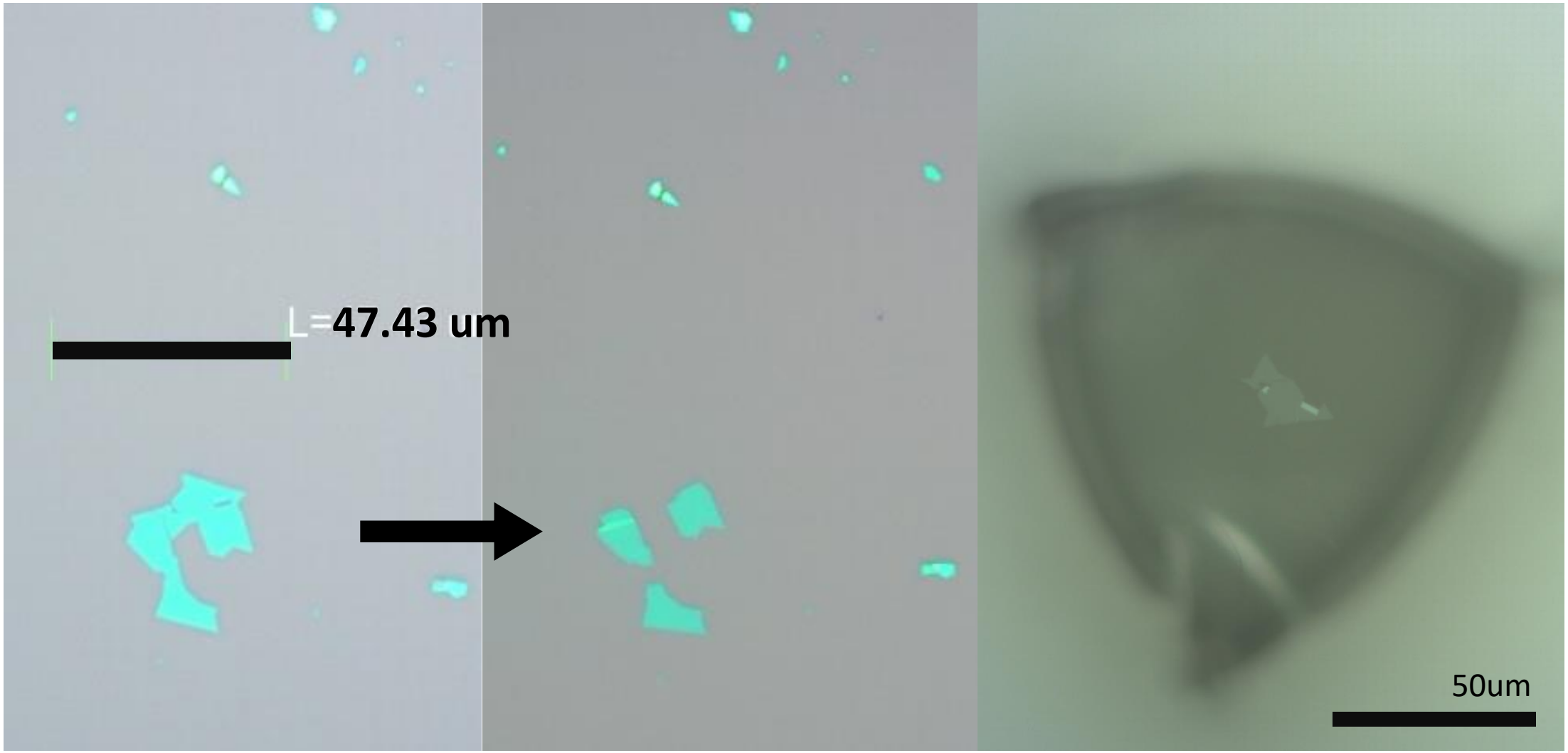


SU-8 mold on Silicon



Patterned PDMS with stamps punched out

Validation and Future Work



Before

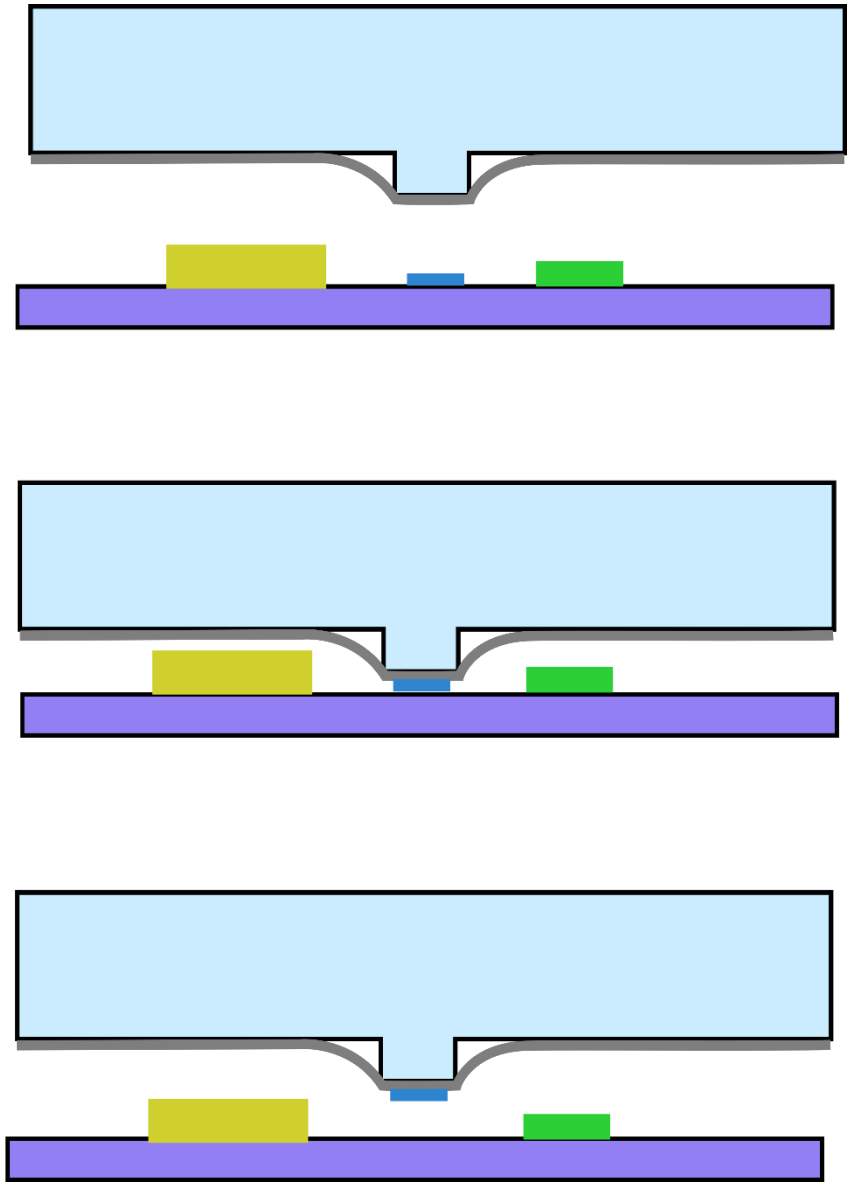
After

Picked-up flake on stamp

Summary

- SU-8 patterning is a promising and facile way to increase spatial selectivity of PDMS transfer slides

- Patterned Spikes offer a powerful tool for the alignment of stacks



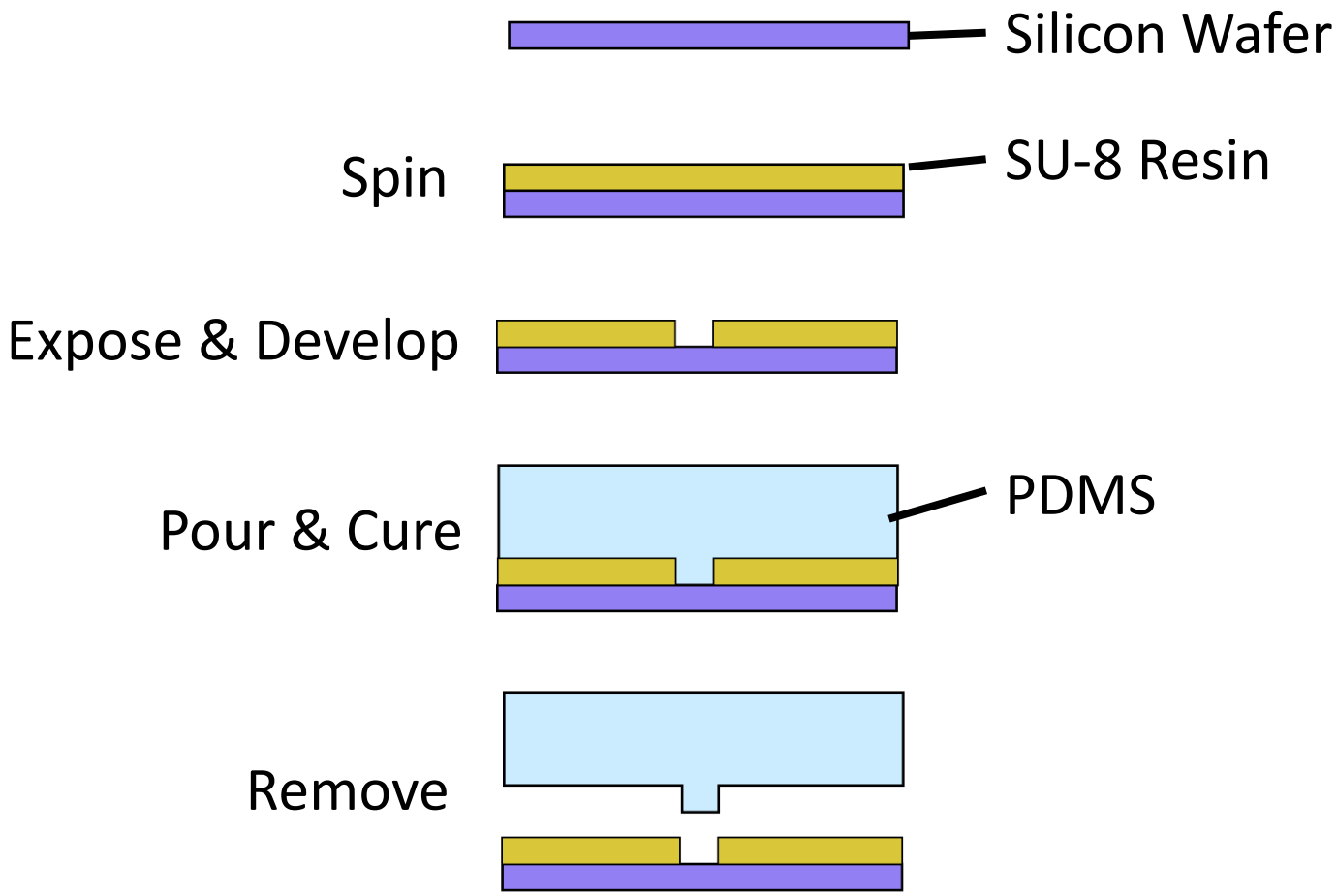
Acknowledgments

- Javier Sanchez-Yamagishi @ UCI

- Benjamin Hunt

- John Lyons, Qingrui Cao, Joe Seifert, Michael Sinko, Dmitry Scherbakov, Erin Grimes

Production of Molds



Production of Slides

1. Punch stamp out of PDMS (prepatterned alignment markings)
2. Stretch polymer film over spike
3. Bake to smooth out or reflow polymer