



MADO Program: Amberstone Biosciences

Athena Niu
Biomedical Engineering

Project objectives

Project Management



Experiment design spreadsheet, timeline, procedures outline

UV Fabrication



Using curable materials to pattern PDMS elastomer through UV illumination



Microfluidic Chip

PDMS chip fabrication and usage in droplet generation



Hydrogel Droplet

Testing hydrogel-based oil encapsulation for droplet generation

Project contents

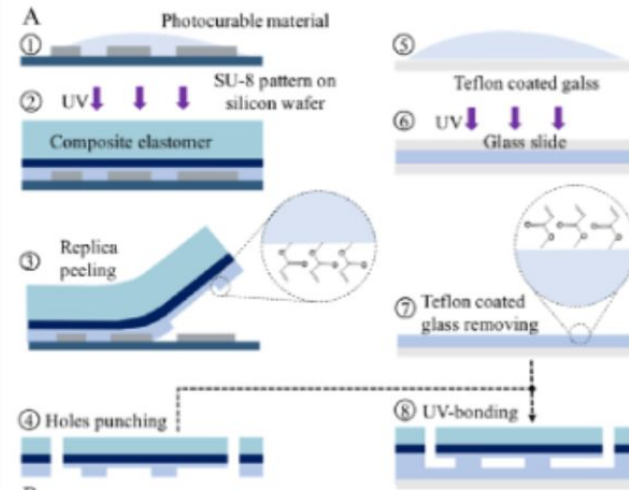
Rapid UV microfabrication project:
investigating a new method of fabrication
for upgrading the current fabrication method
to be more robust, reliable, and efficient.

- Photolithography
- Soft lithography
- Working with photocurable soft materials

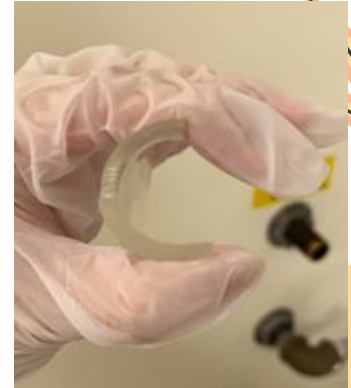
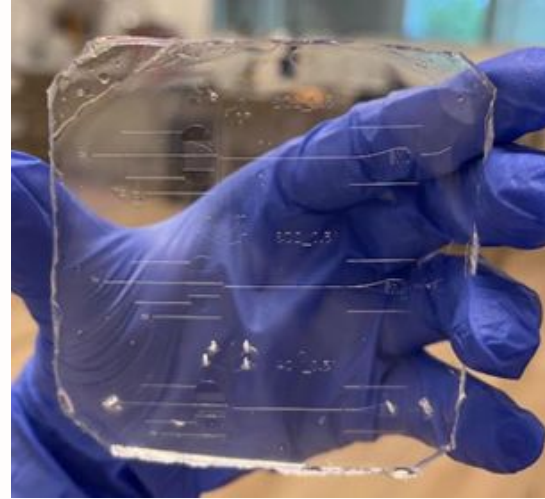
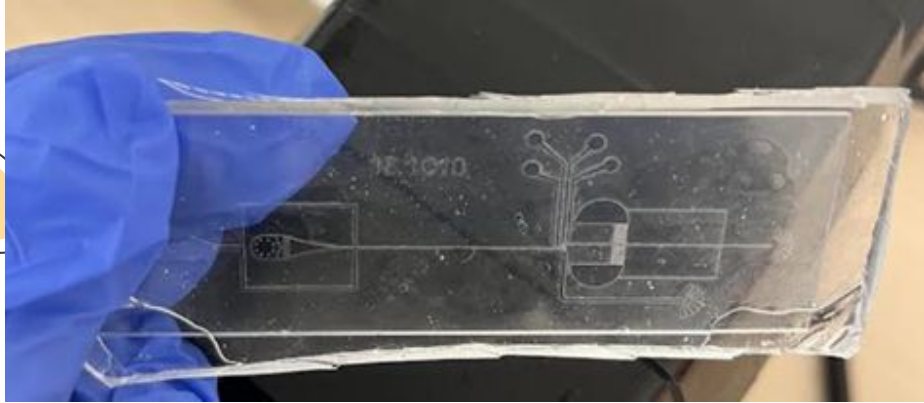
Hydrogel project:
to use a more biocompatible material for
droplet generation

Method and Robustness

- Step 1: Fabricate PDMS composite
- Step 2: Rapid UV photofabrication



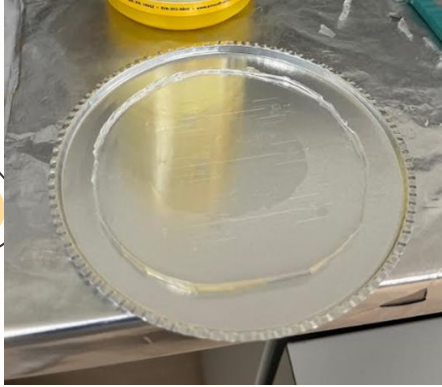
Chip fabricated with UV illumination



Journey in fabrication, quality control



Side Projects



Making chip mold with liquid plastic

Testing hydrogel samples for oil-encapsulated droplet generation

- Gel starts to stiffen after 15 minutes

1	Goal: to fabricate PDMS Composite Elastomer using new method with photocurable material					
2						
3	Materials	Volume/unit (first trial)	Second trial	Third trial (2 glass slides)	Fourth trial	Ratio
4	BPADA	1.77mL	Same	Same	Same	59%
5	AMA	1.2mL				40%
6	HMPP	30μL				1%
7	FluroAcryl (PFPEDA)			1mL		
8	PDMS	12g total, 8-10g used	21g total, 15-20g used	23g total	20.4g total	5:1
9	Silicon wafer					
10	HFE-7500/FC-40	7.5mL	5.75mL	5mL	5mL	
11	Glass plates		2	2		
12	PFTEDS	75μL	57μL	50μL	50μL	
13						
14						
15	Procedures (1st trial)					
16	1. Vacuum filter the oil and add in PFTES. Soak one glass slide in it and set aside (soaked for around 1 hr)					
17	2. Make mixture of BPADA, AMA, HMPP (in fume hood). Total should be 3mL but we made around 3.5mL yesterday.					
18	3. Cast the mixture on the untreated glass slide (around 660μL was used) and cover with the treated glass slide.					



Takeaways

Skills learnt

- Research
- Decision making
- Materials management
- Microfluidic chip fabrication
- Product development
- Quality control
- Problem solving

Difficulties

- Getting stuck in the middle and not knowing how to improve
 - Wafer coming off
 - Spacer
 - Bubbles/Cracks
- Getting inconsistent results

