

Department of Biomolecular Sciences & Engineering Department of Mechanical Engineering

Detection of illicit drugs







Detection of Methamphetamine Using Microfluidics



Andreou, Chrysafis, et al. "Rapid Detection of Drugs of Abuse in Saliva Using Surface Enhanced Raman Spectroscopy and Microfluidics." *ACS nano* (2013).

What is Microfluidics?

- Manipulation of small amounts of fluids which:
 - o Controls flow and mixing
 - o Uses small amounts of reactants
 - o Enables controllable reactions to occur



http://phys.org/news/2013-03-inexpensive-microfluidic-device-rapid-point-of-care.html

Project Goals

- Fabricate a microfluidic device
 o Use UV-Curable polymers (NOA81)*
- Operate device using constant pressure flow
- Characterize flow with visualization techniques
 - o micro- Particle Image Velocimetry (µPIV)
 - o fluorescent dye
 - o high speed camera

* Bartolo, Denis, et al. "Microfluidic stickers." Lab on a Chip 8.2 (2008): 274-279.

<u>Schematic of our Microfluidic</u> <u>Device</u>





(2008): 274-279.

Operating the Device



<u>Micro Particle Image Velocimetry</u> (µPIV)



Δt = 500 μs



v= 24 cm/s $\Delta P=1$ Atm



Visualizing diffusion with fluorescent dye



 $\Delta P=1$ Atm

 $\Delta P=0.4$ Atm

Visualizing droplet flow with high-speed Camera



 $\Delta P_{Oil} = 1.9 \text{ Atm}$

 ΔP_{water} =1.3 Atm

560 droplets/second

 $\Delta P_{oil} = 1.6$ Atm

ΔP_{water}=1.3 Atm



3,400 droplets/second

5,045 FPS

Conclusion

 We created a microfluidic device, using UV-Curable polymers

o Operated the device using constant pressure flow

- Characterized flow using various visualization techniques
- Moving forward we hope to use Microfluidic to detect narcotics



Acknowledgement

Anthony Karmis, Jacob Feinberg-Somerson, Chrysafis Andreou, Meinhart Labs, photographers, Matt Crossely



CALIFORNIA NANOSYSTEMS INSTITUTE

UNIVERSITY OF CALIFORNIA SANTA BARBARA

CSEP CENTER FOR SCIENCE AND ENGINEERING PARTNERSHIPS

 $x = \sqrt{2Dt} \quad D = \frac{k_b T}{6\pi r\eta}$