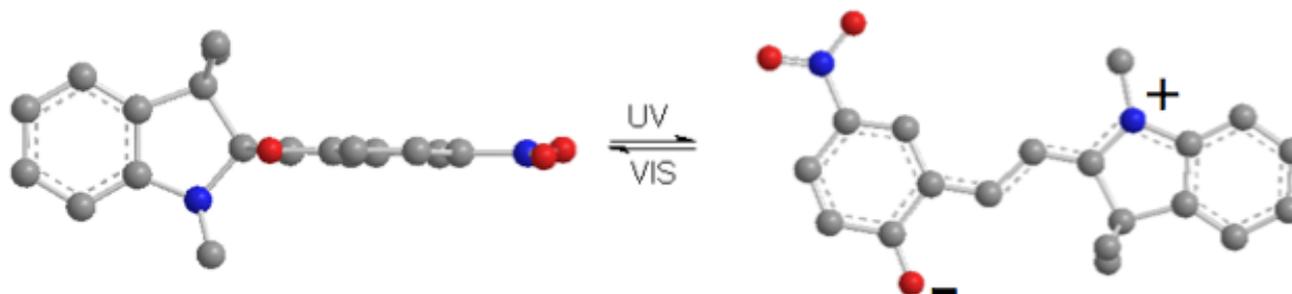


Photo-Controlled Molecular Switches for Flow Modulation In Microfluidic Devices

October 2014

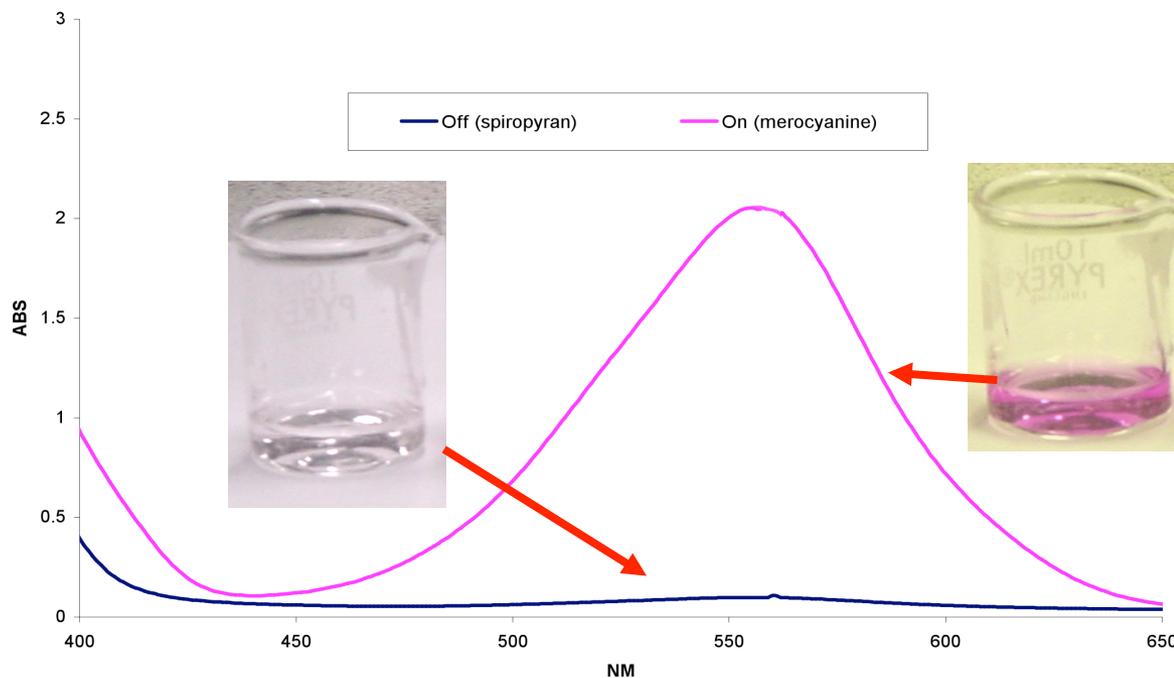
Larisa Florea
Prof. Dermot Diamond

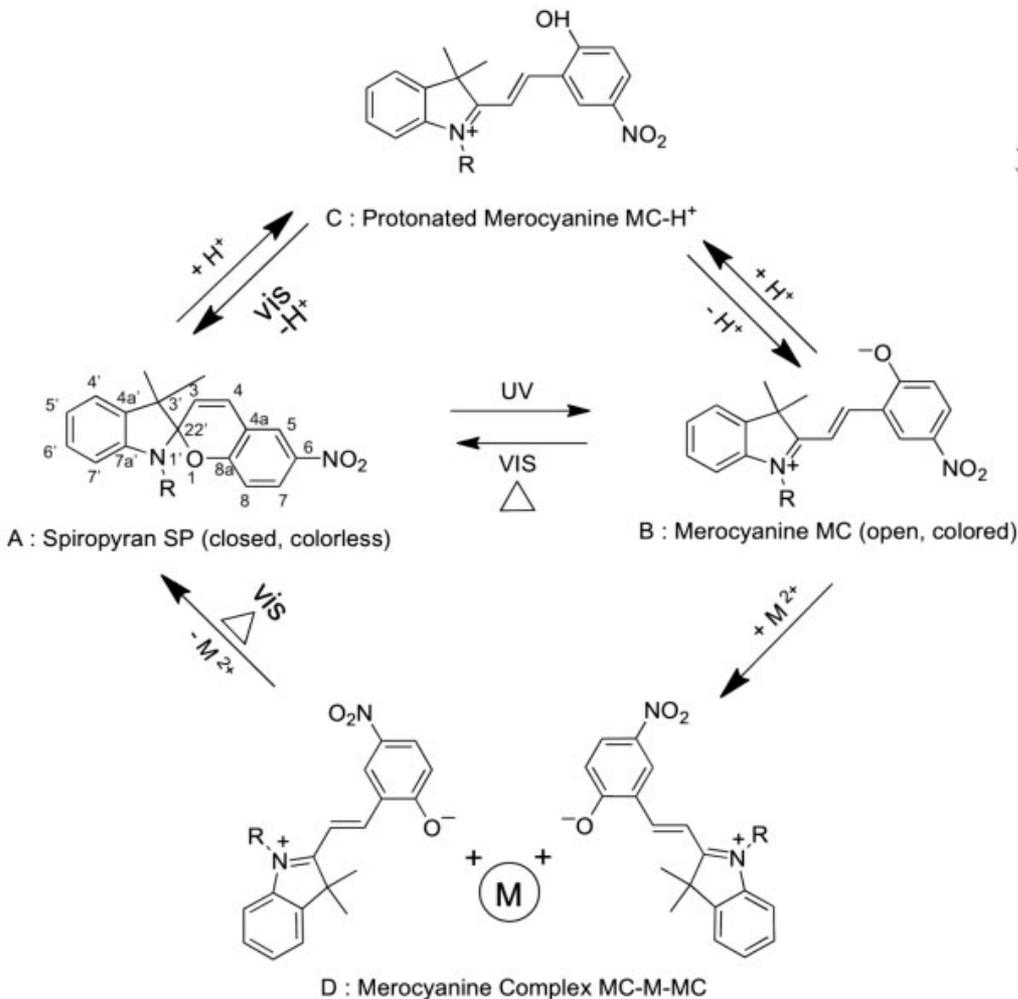
Spiroopyrans



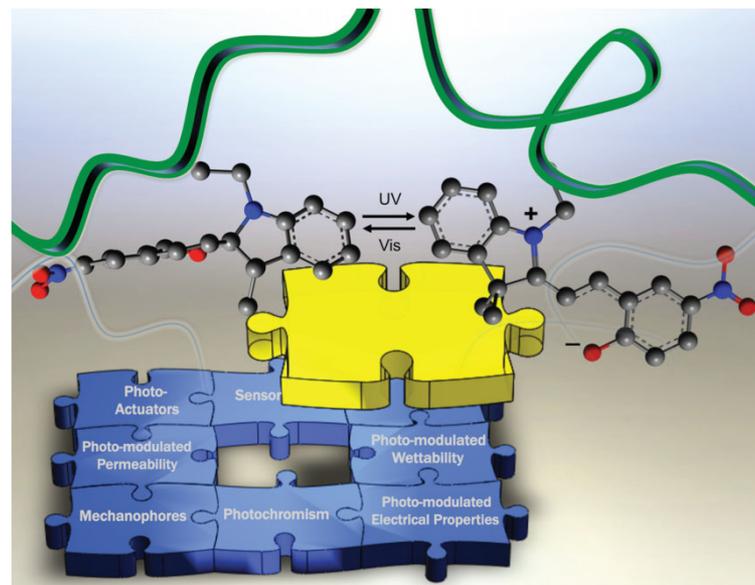
A : Spiropyran SP (closed, colorless)

B : Merocyanine MC (open, colored)





Macromolecular Materials and Engineering



Special Issue:
Advances in Actively Moving Polymers
Guest-edited by Andreas Lendlein

12/2012

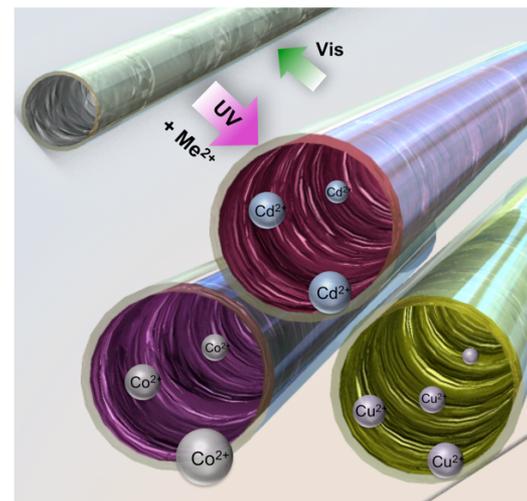
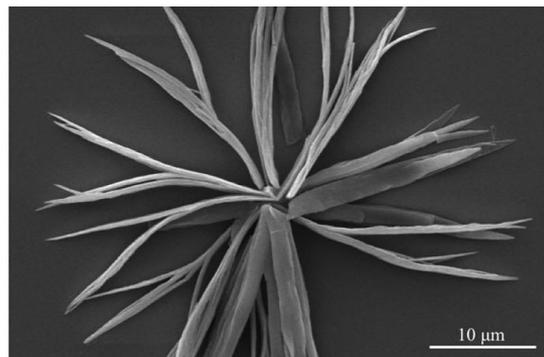
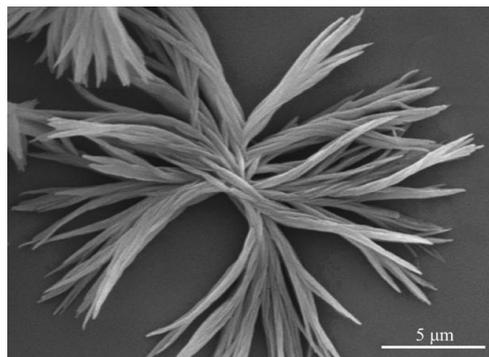
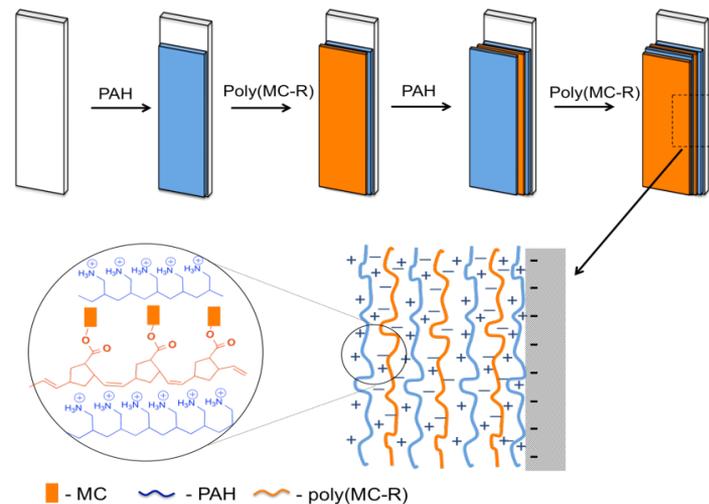
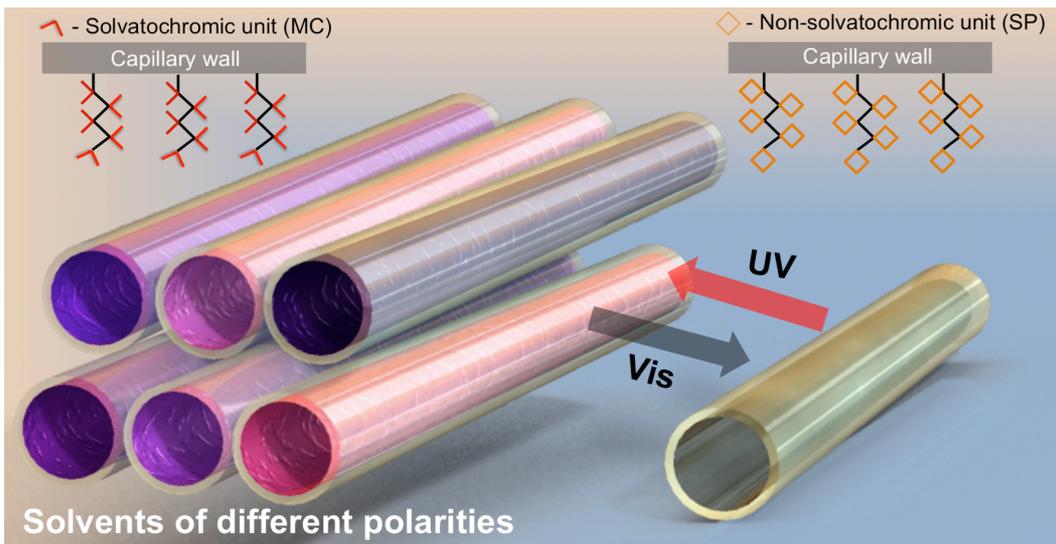
WILEY-VCH

L. Florea, D. Diamond and F. Benito-Lopez, *Macromolecular Materials and Engineering*, 2012, 297, 1148-1159.





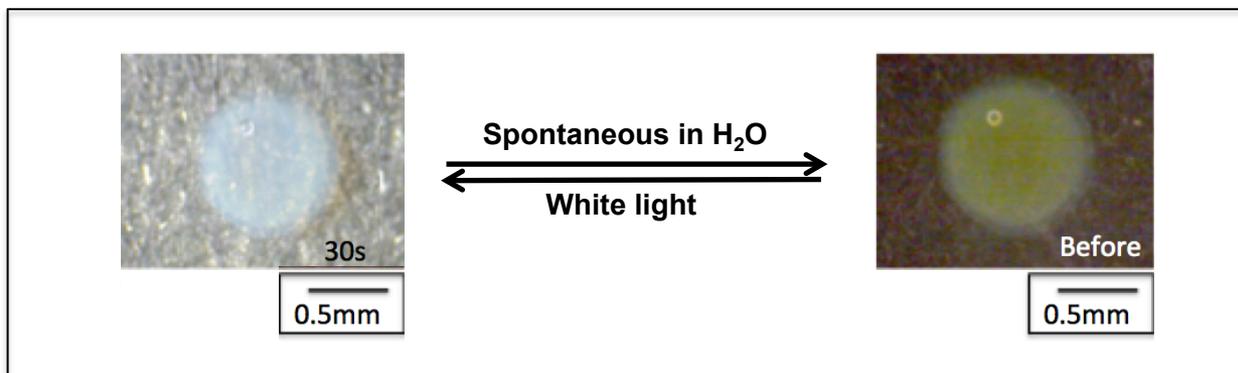
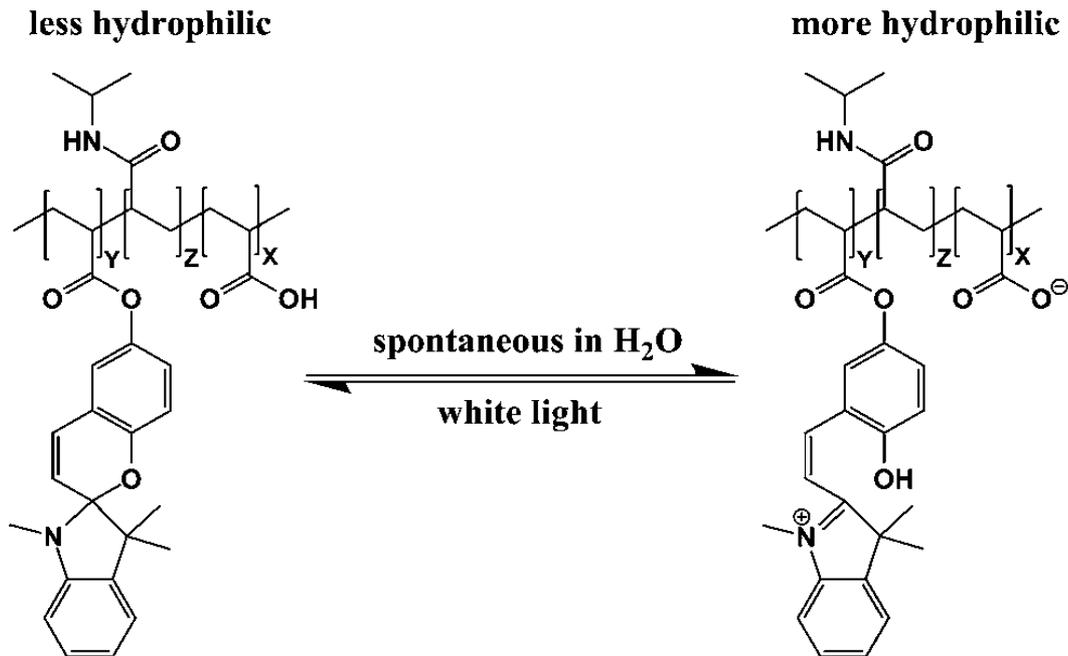
Spiropyrans



L. Florea, S. Scarmagnani, F. Benito-Lopez, D. Diamond *ChemComm*. 2014.

L. Florea, A. Hennart, D. Diamond and F. Benito-Lopez, *Sens. Actuators B: Chem.*, 2012, 175, 92-99.

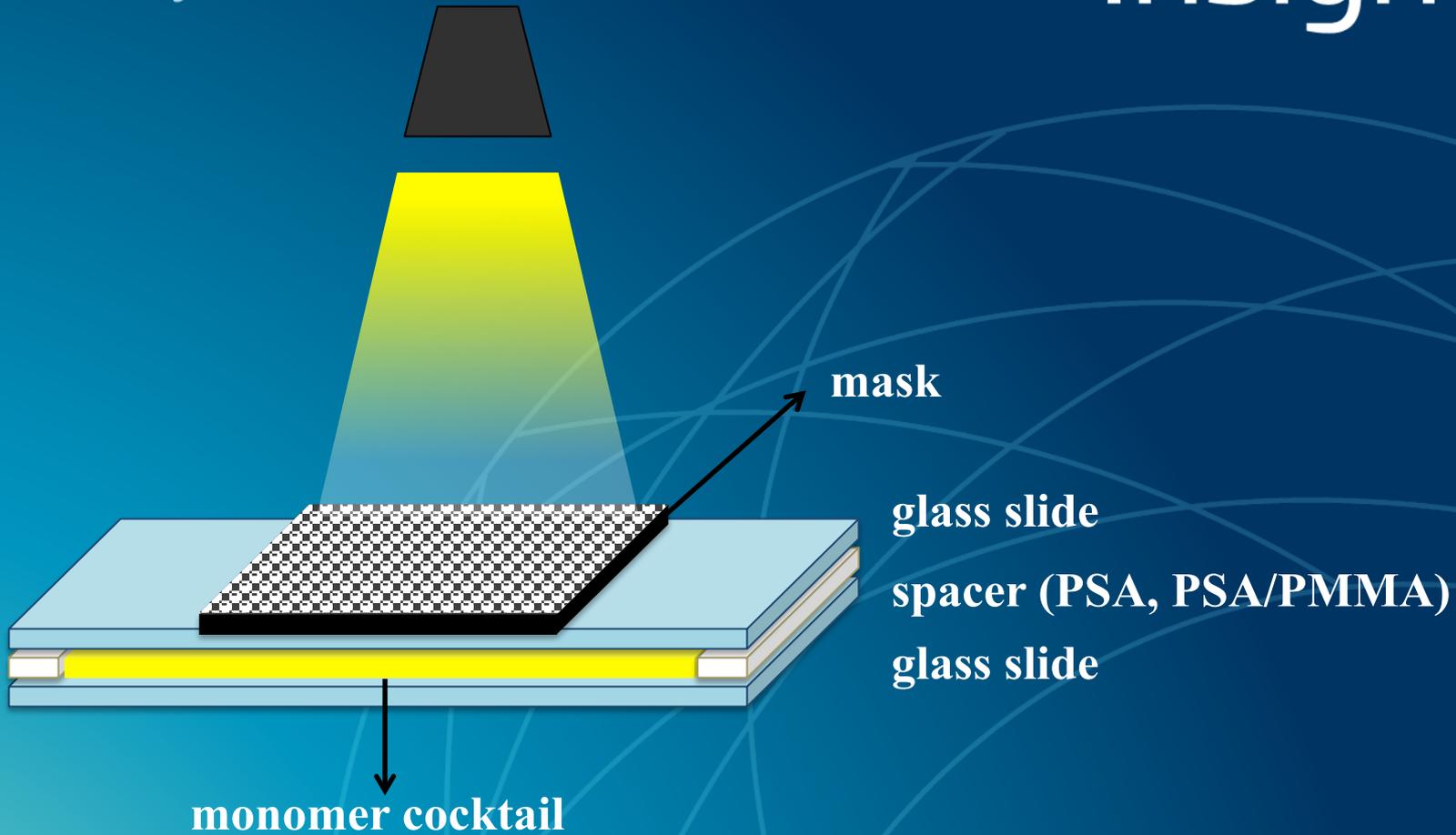
L. Florea, A. McKeon, D. Diamond and F. Benito-Lopez, *Langmuir*, 2013, 29, 2790-2797.



Microstructures preparation

Centre for
Data Analytics

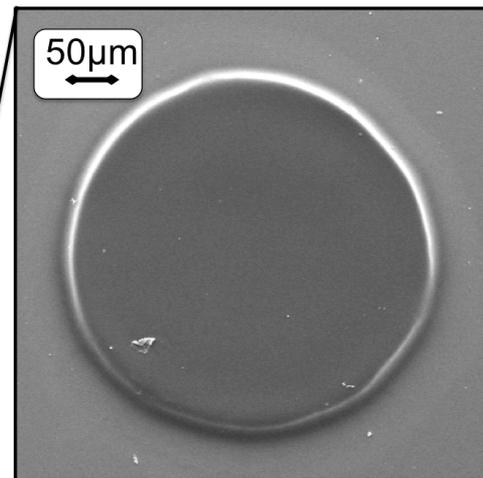
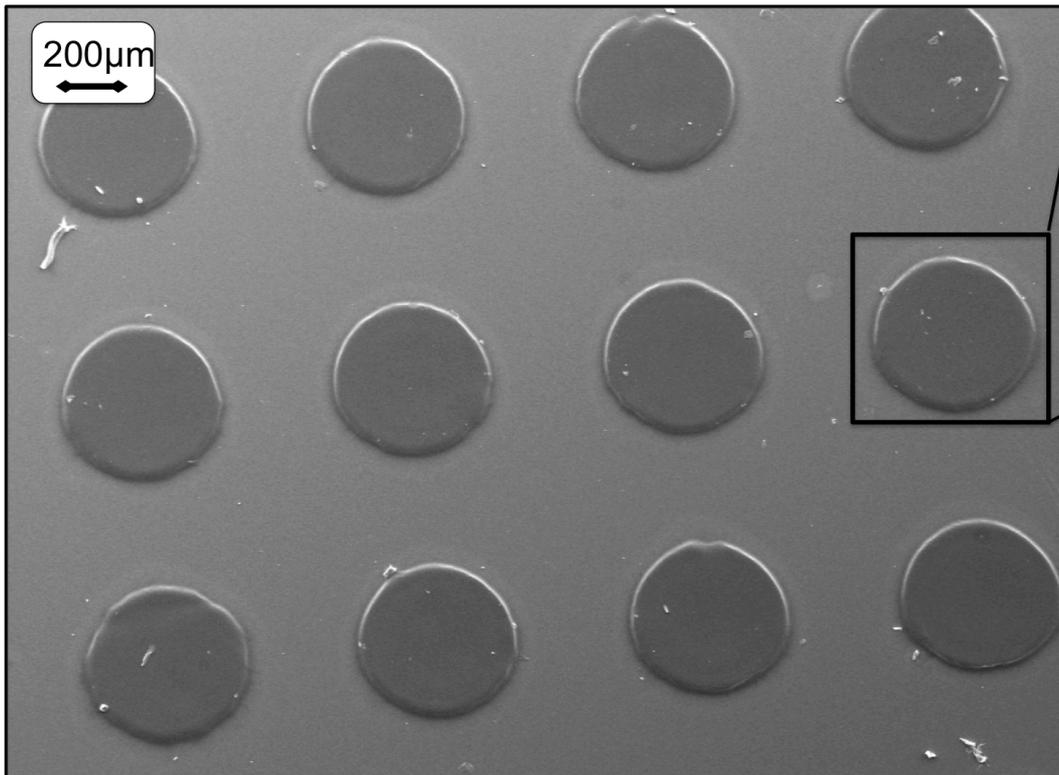
Insight 





Micro-patterned hydrogels

Hydrogel microstructures covalently attached to glass substrates were photopolymerised through micro-patterned masks using white light.



- Circular masks of 1mm diameter.
- Hydrogel height: 60μm.
- Polymerisation time: 10-20 seconds.



Photo-responsive hydrogels

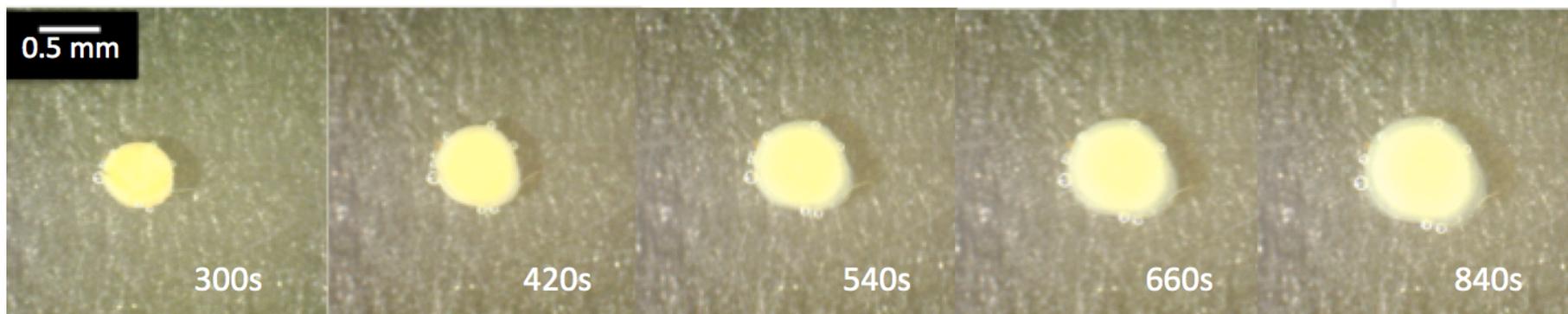
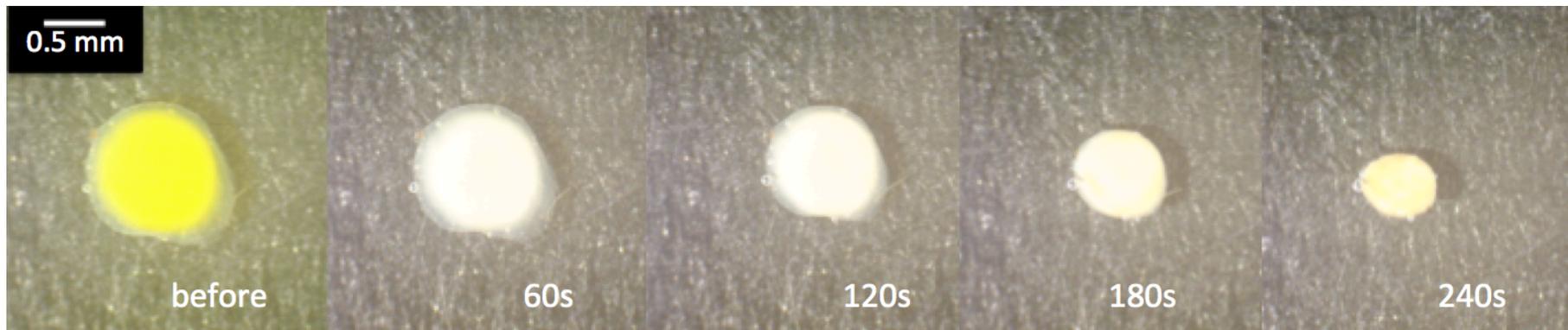




Photo-responsive hydrogels

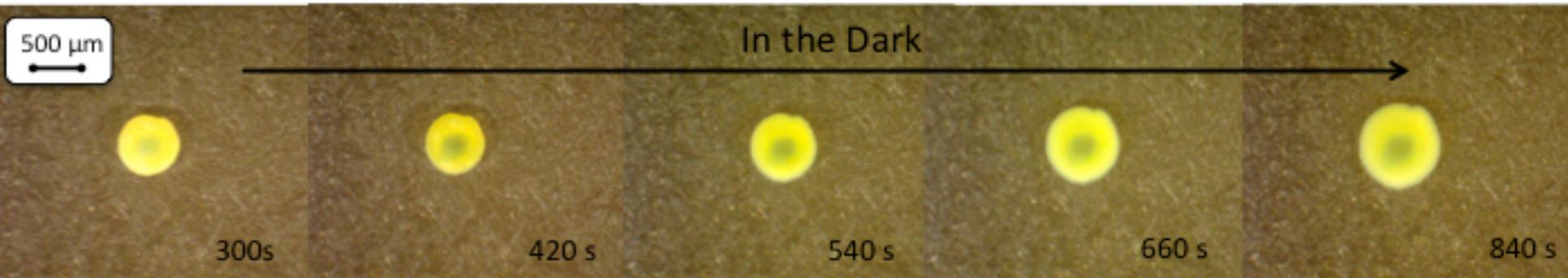
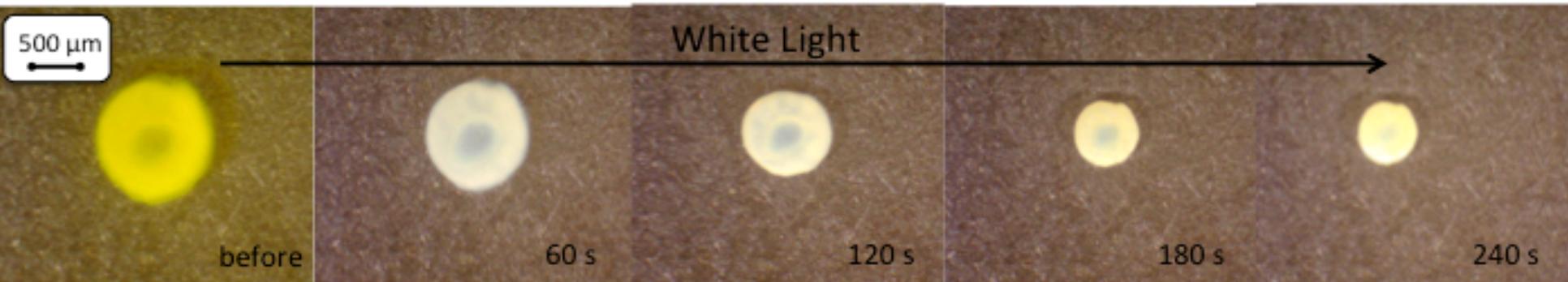
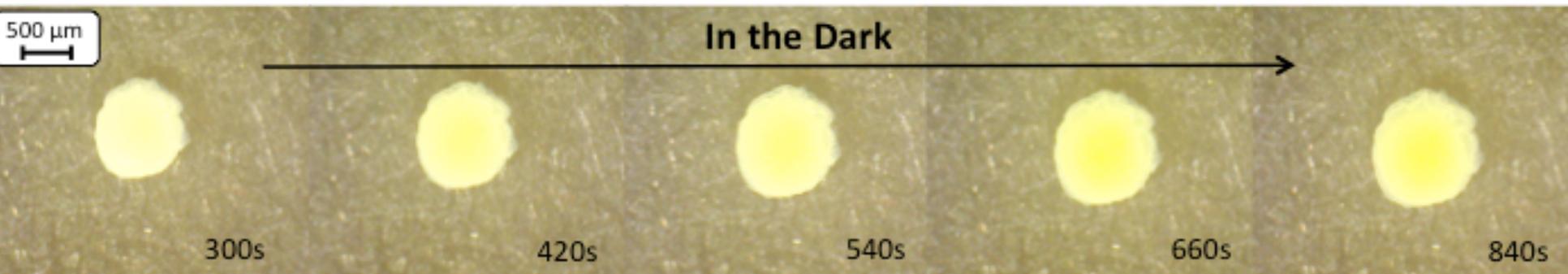


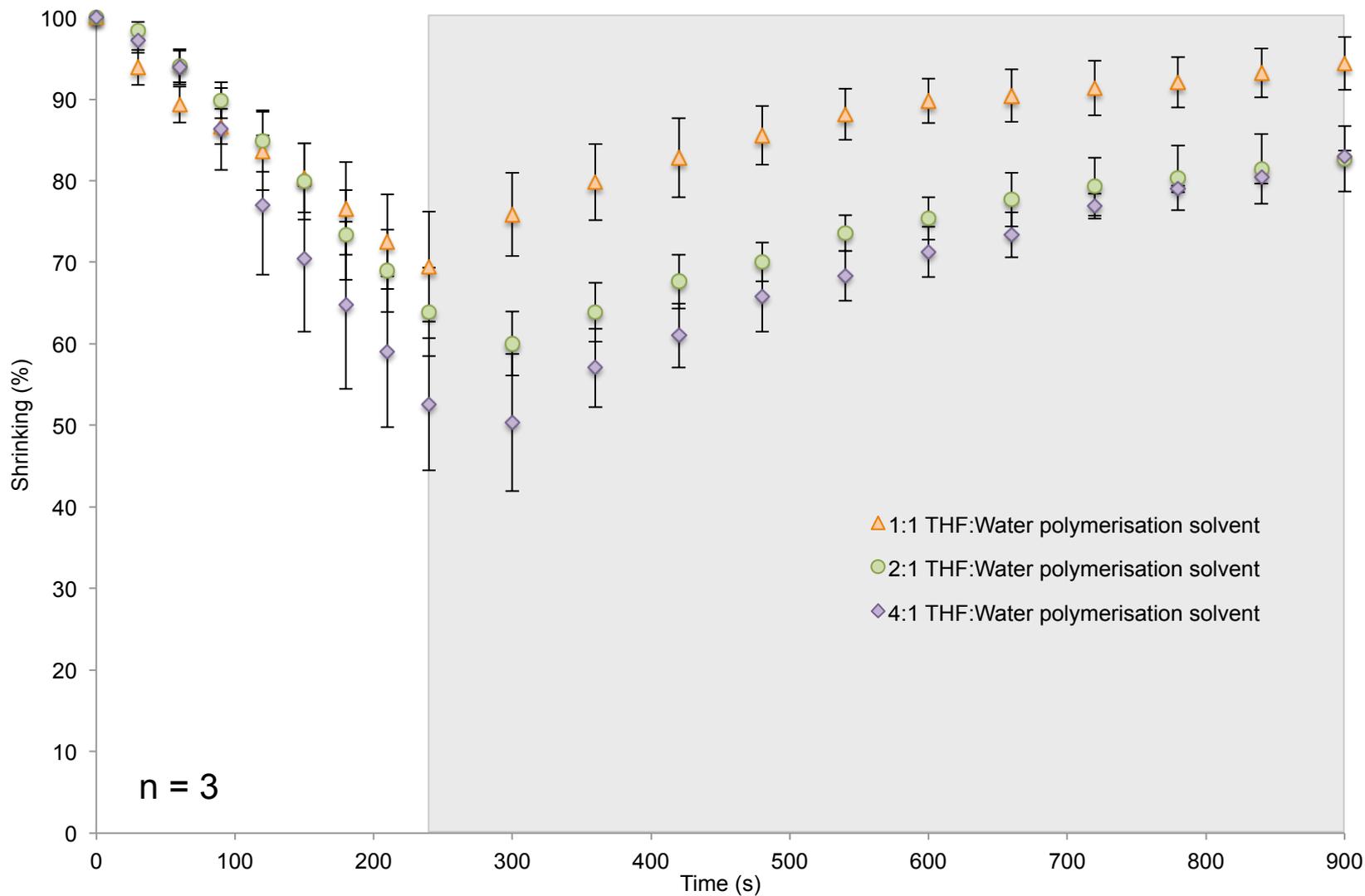


Photo-responsive hydrogels



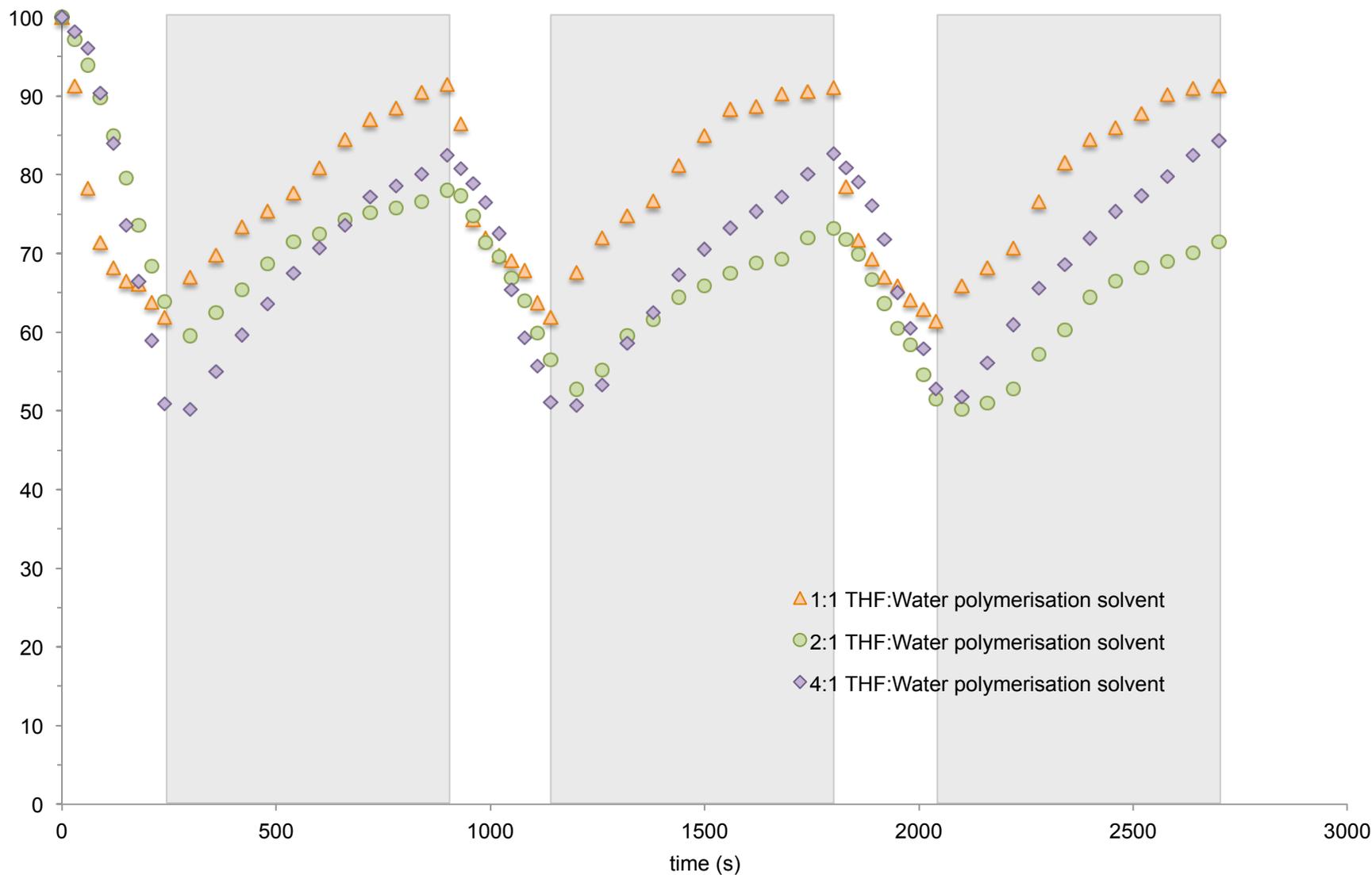


1st irradiation cycle





Multiple irradiation cycles

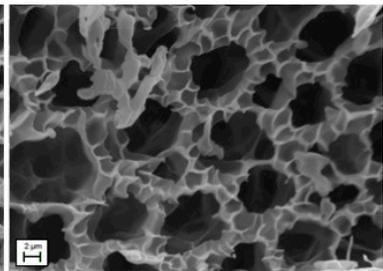




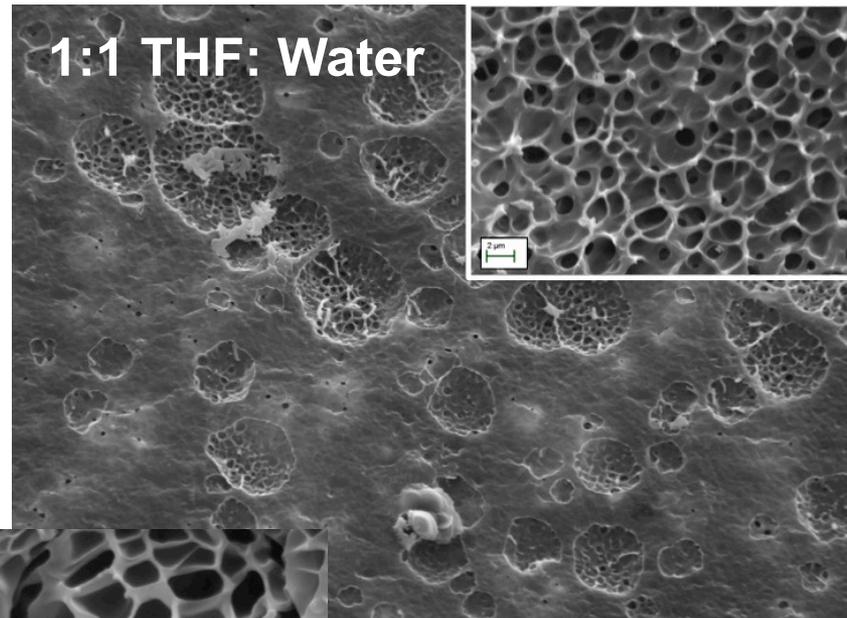
SEM Imaging



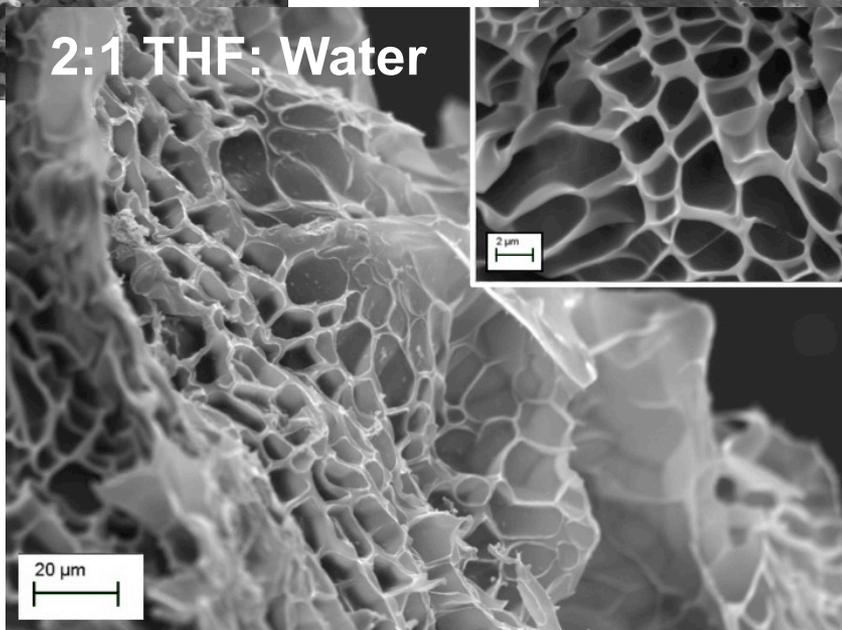
4:1 THF: Water



1:1 THF: Water



2:1 THF: Water



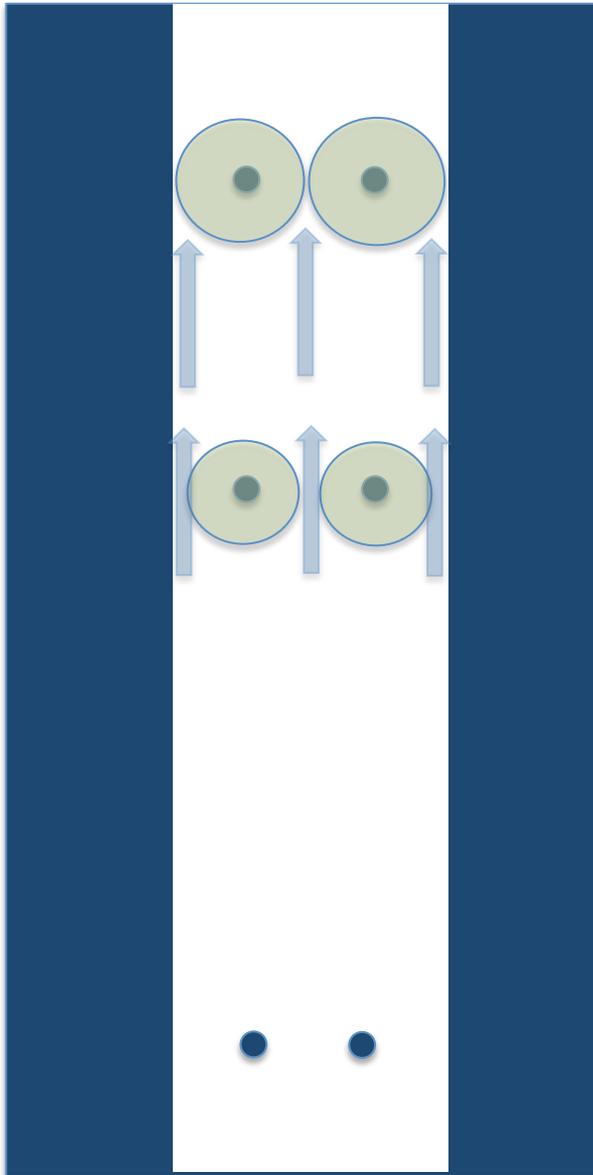


Valve applications

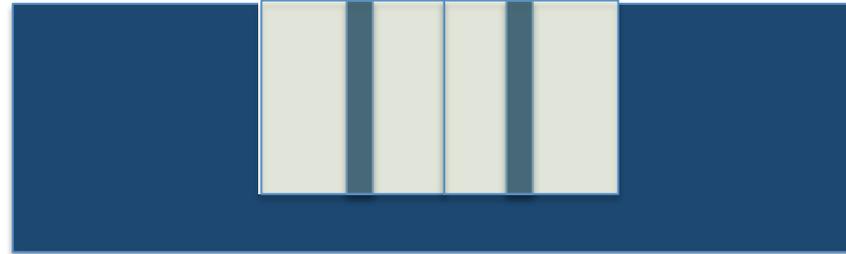




Micro-valve fabrication and working principle

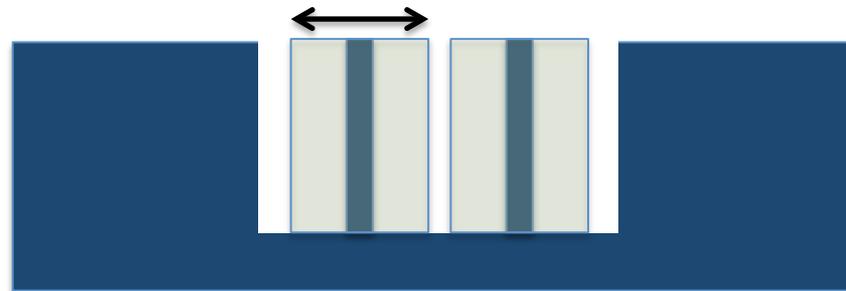


3

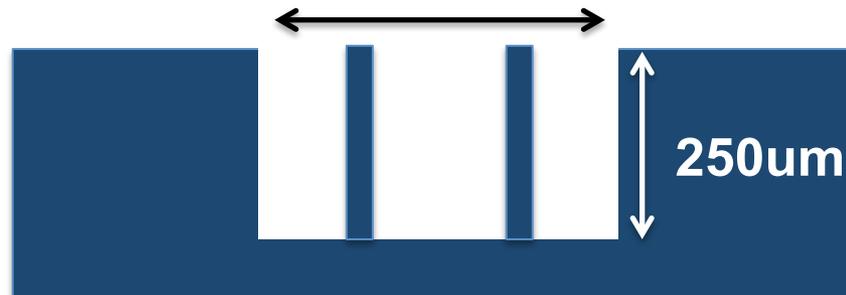


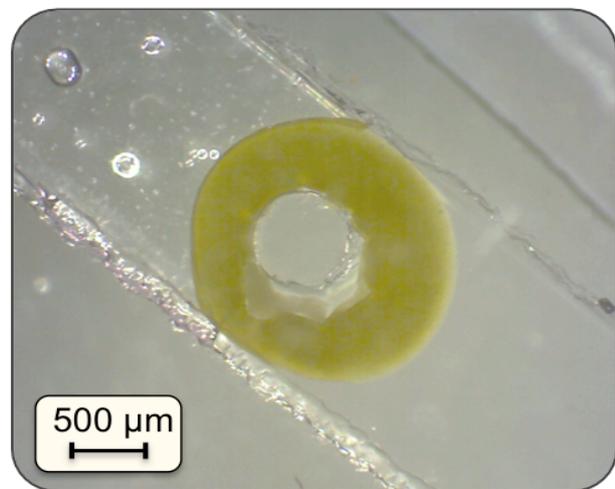
250um gel disks polymerised around pillar using mask

2



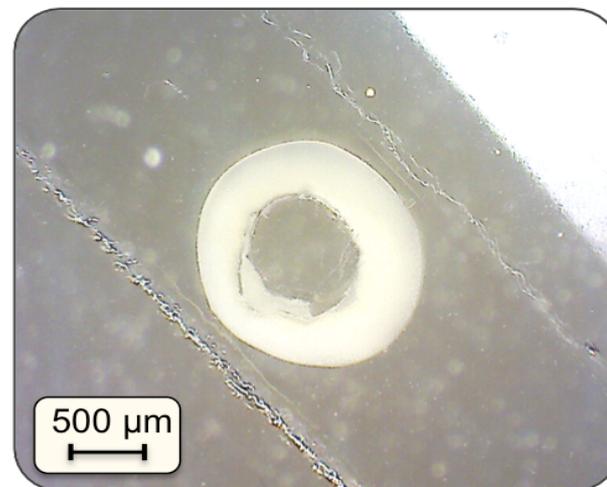
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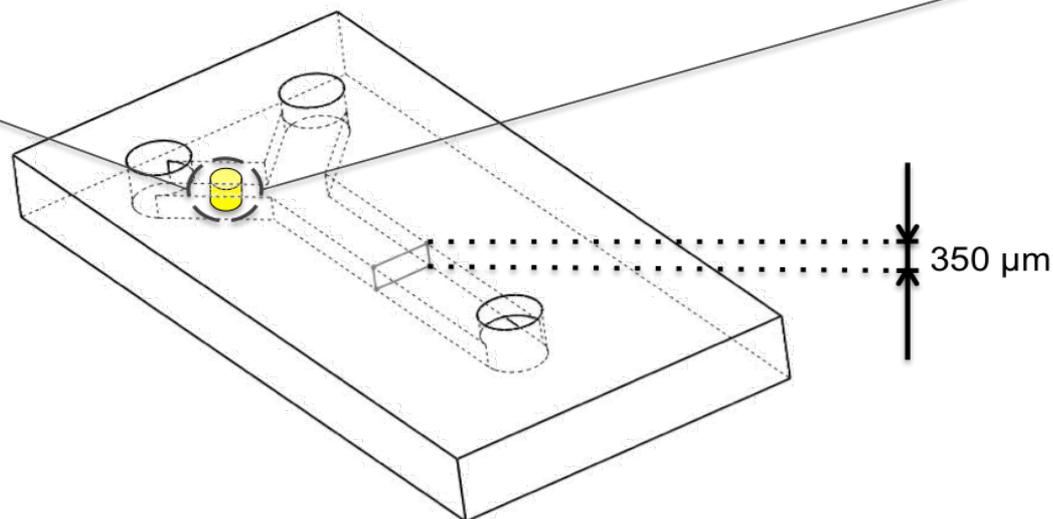


CLOSED

White light
↔
Dark



OPEN





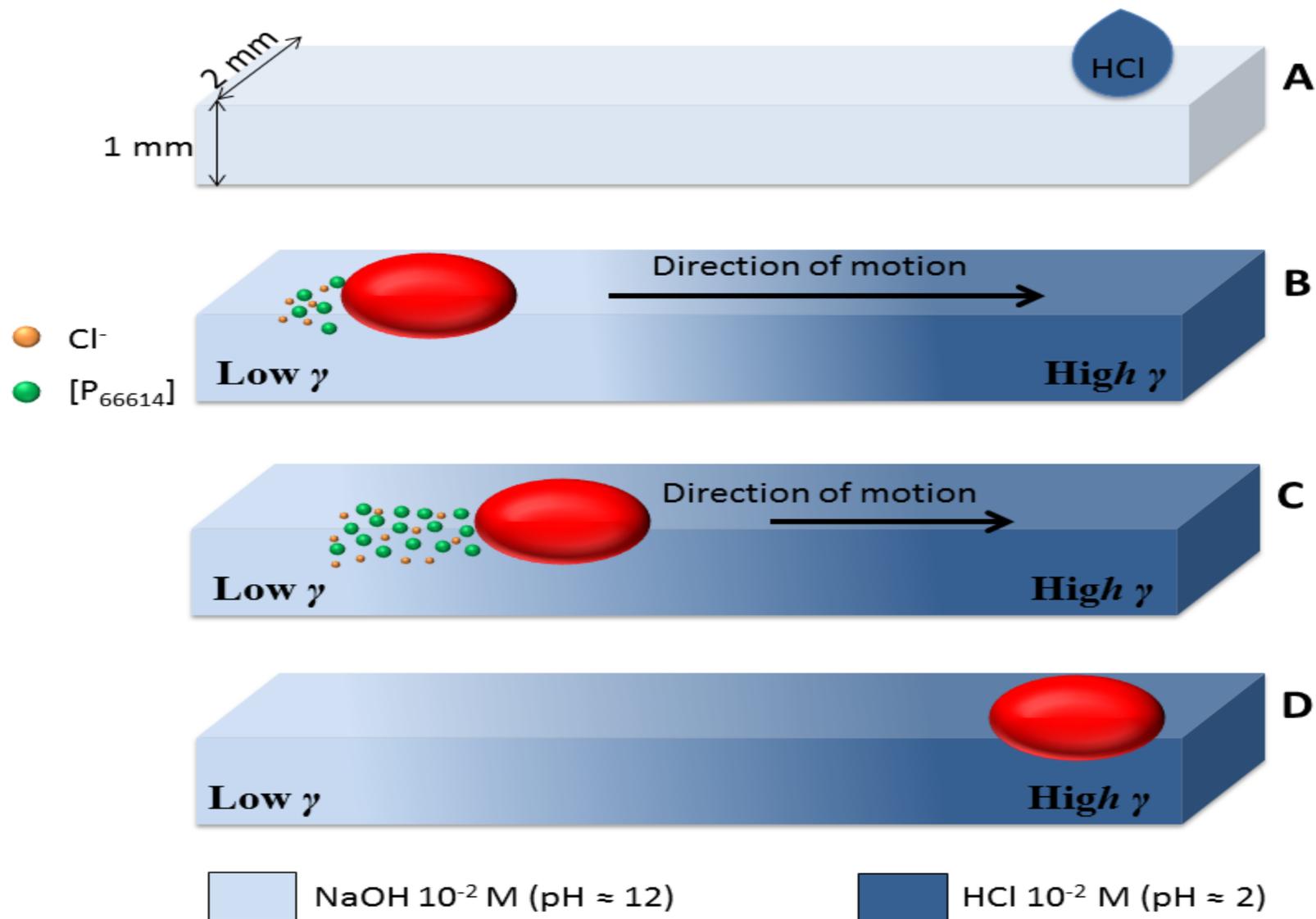
Surfactant-driven vehicles

Chemotactic Droplets





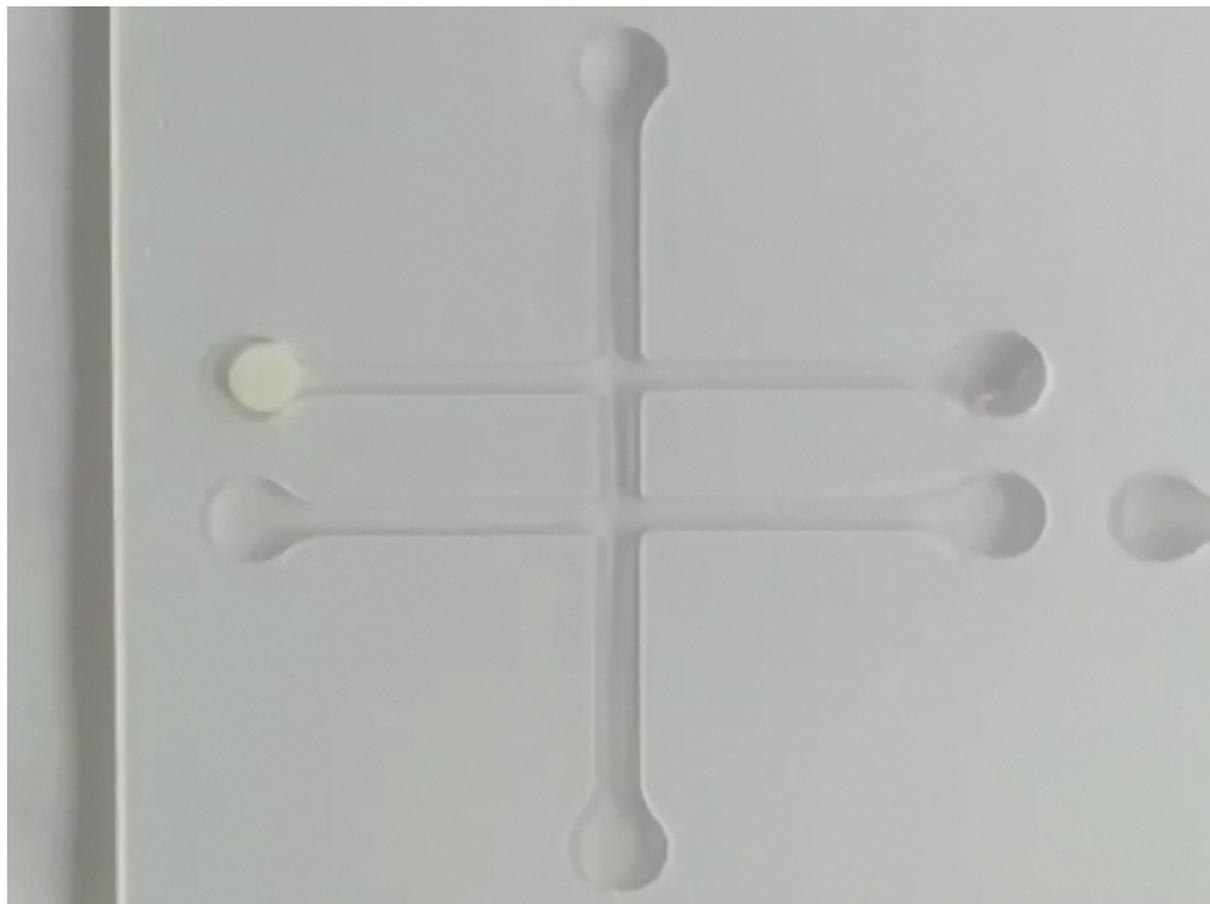
Controlled-release of surfactants





Video 1

Chemoattractant: HCl soaked Gel

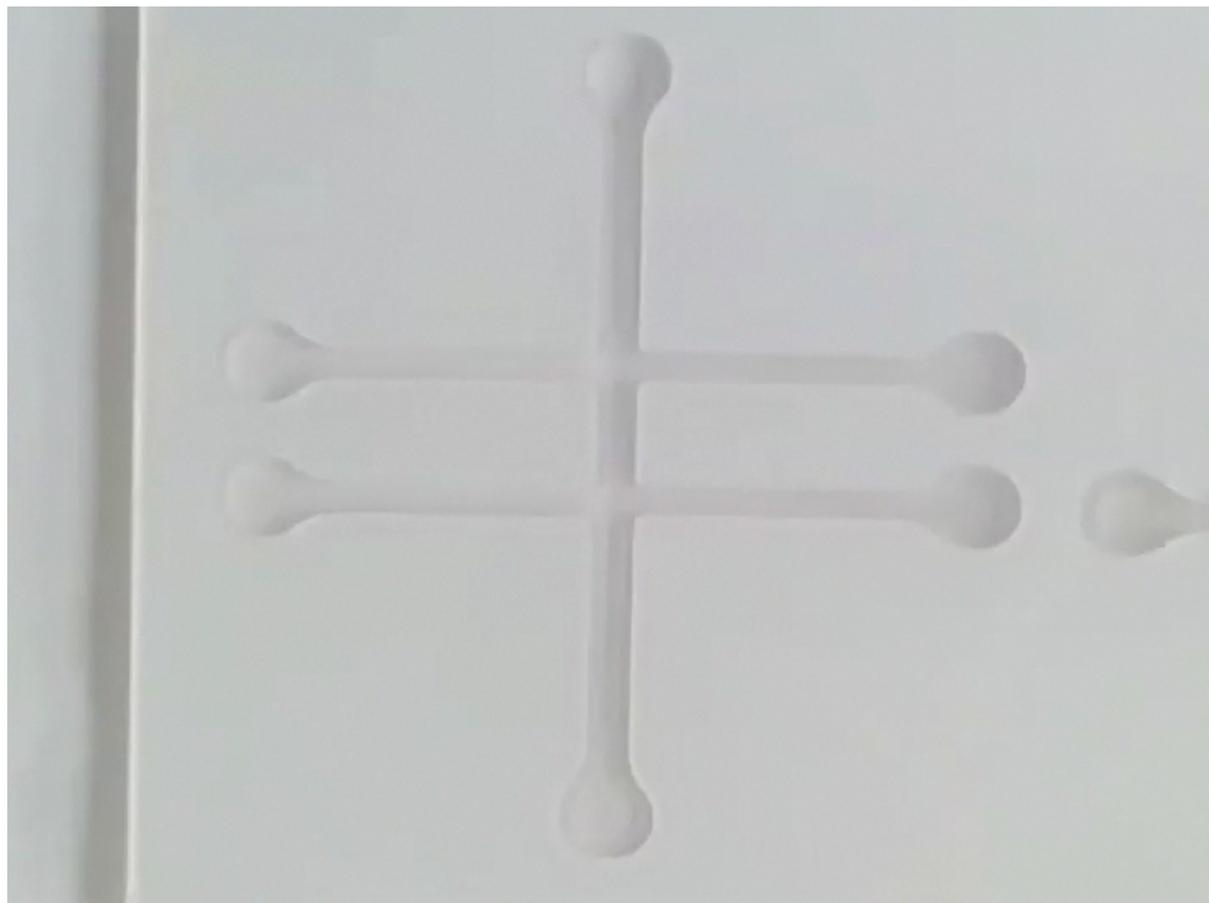


Speed X 4





Video 2: Chemoattractant: Solution of HCl



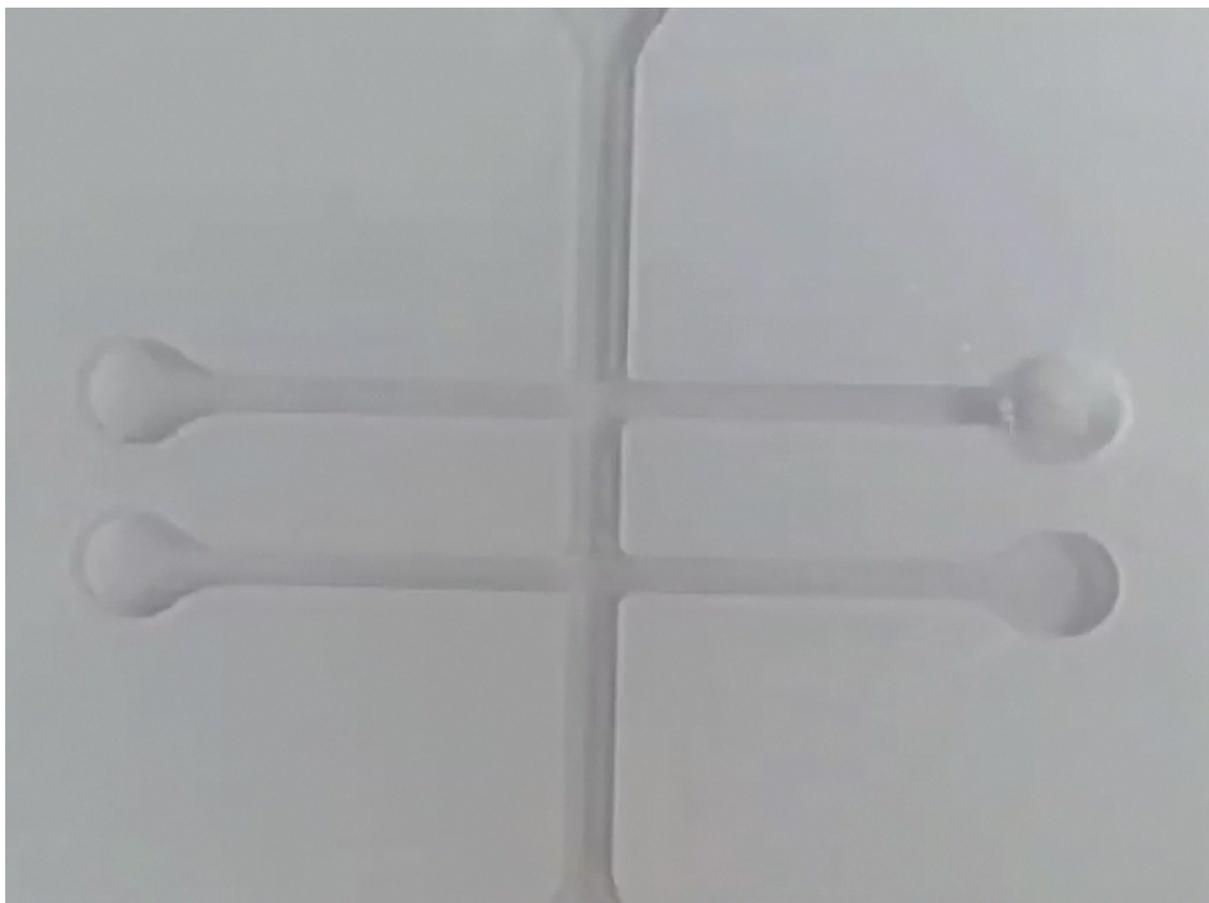
Speed X 2





Video 3

Chemoattractant: NaCl crystals

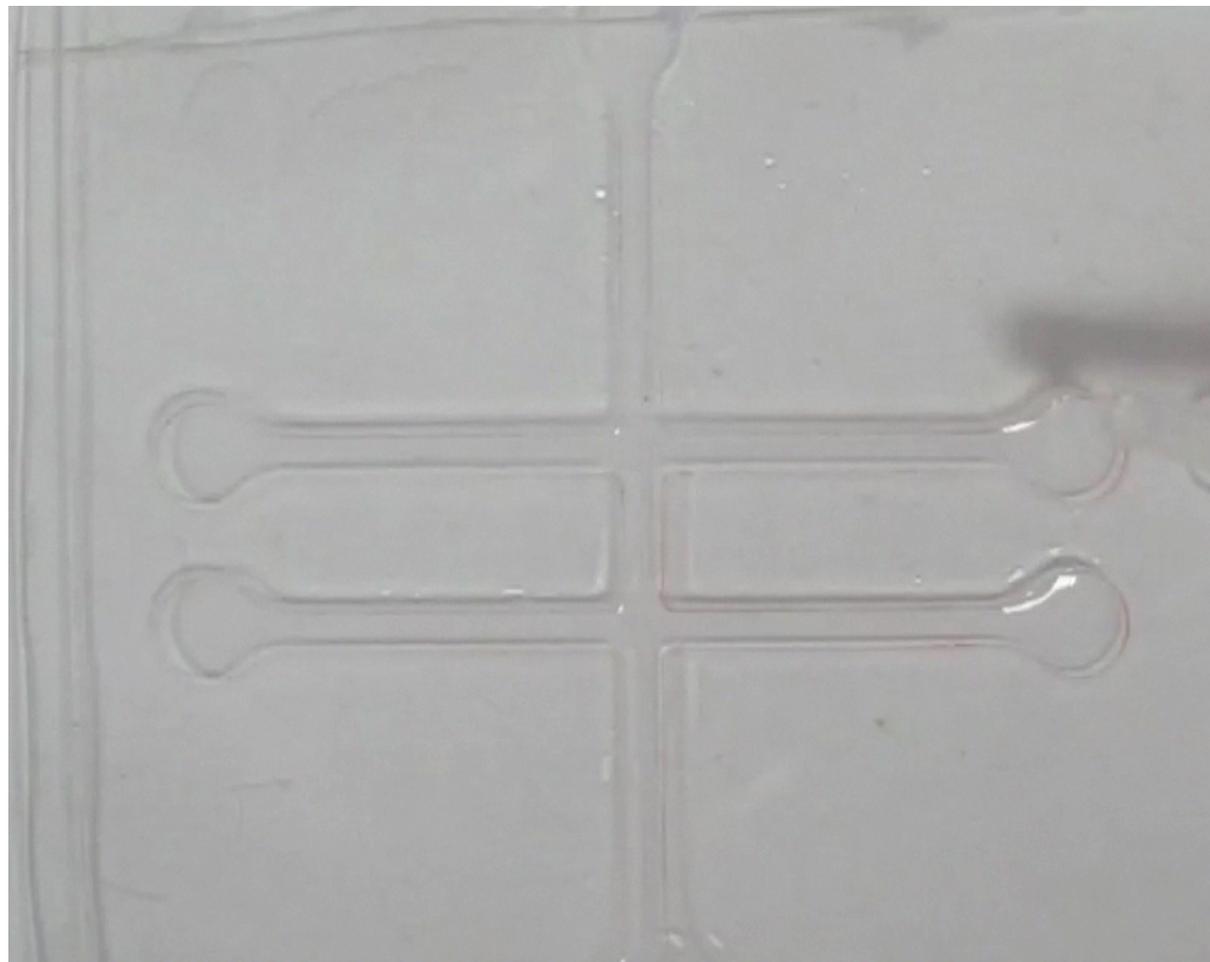


Speed x 4





Multiple Chemotactic Droplets



Speed X 2





Electro-activated chemopropulsion



Speed X 4

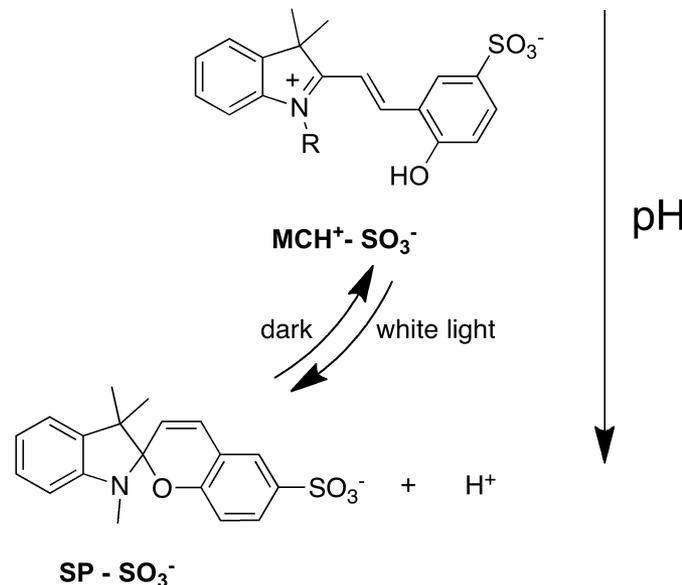
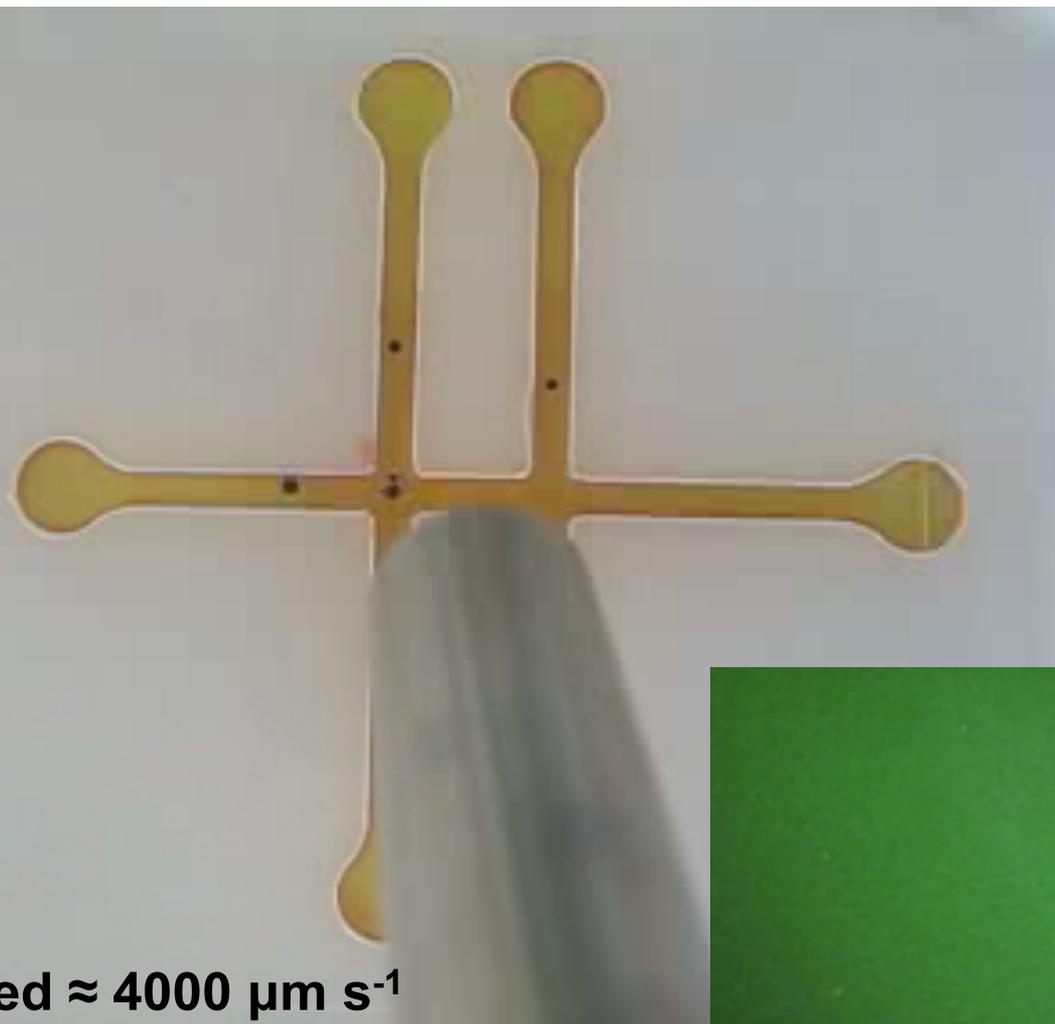


OÉ Gaillimh
NUI Galway

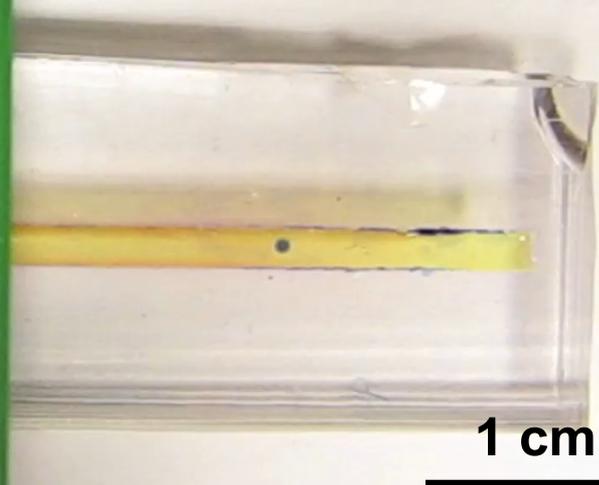




Photo-activated chemopropulsion



Speed $\approx 100 \mu\text{m s}^{-1}$



Speed x 4

Speed $\approx 4000 \mu\text{m s}^{-1}$

[1] Florea, L., Wagner, K., Wagner, P., Wallace, G. G., Benito-Lopez, F., Officer, D. L., Diamond, D. *Advanced Materials* (2014)
DOI: 10.1002/adma.201403007.



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- **Prof. Dermot Diamond**
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Thank you!

