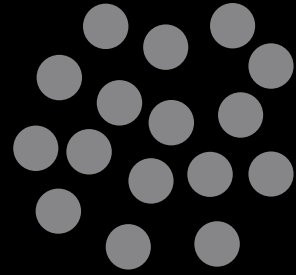


Photonic Pigments from Biocompatible Bottlebrush Block Copolymers

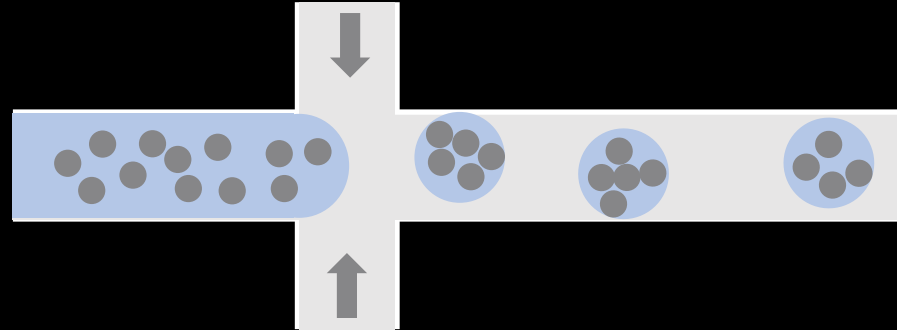
Zhen Wang, Richard Parker, Silvia Vignolini

<http://www.ch.cam.ac.uk/group/vignolini/>

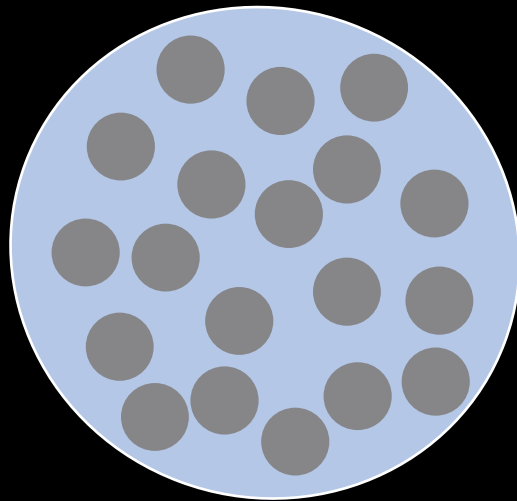
Colloidal self-assembly for pigment



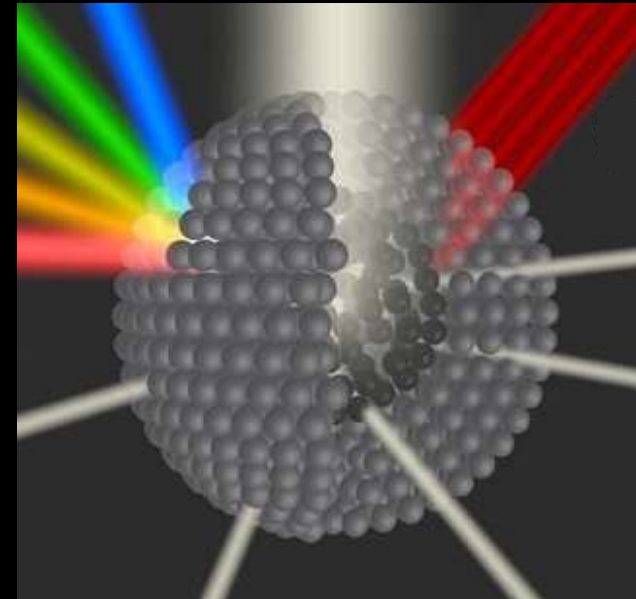
Nanoparticles



Microfluidics



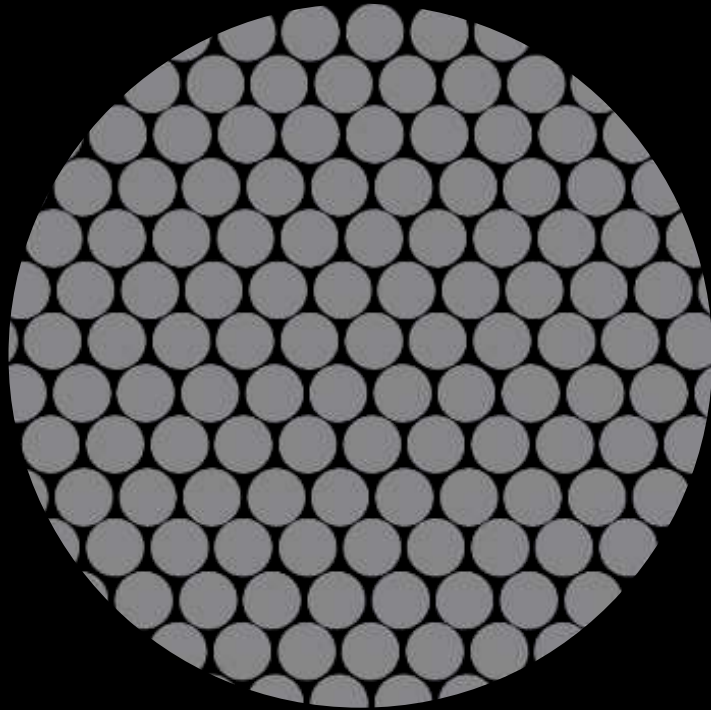
Confined self-assembly



Photonic pigment

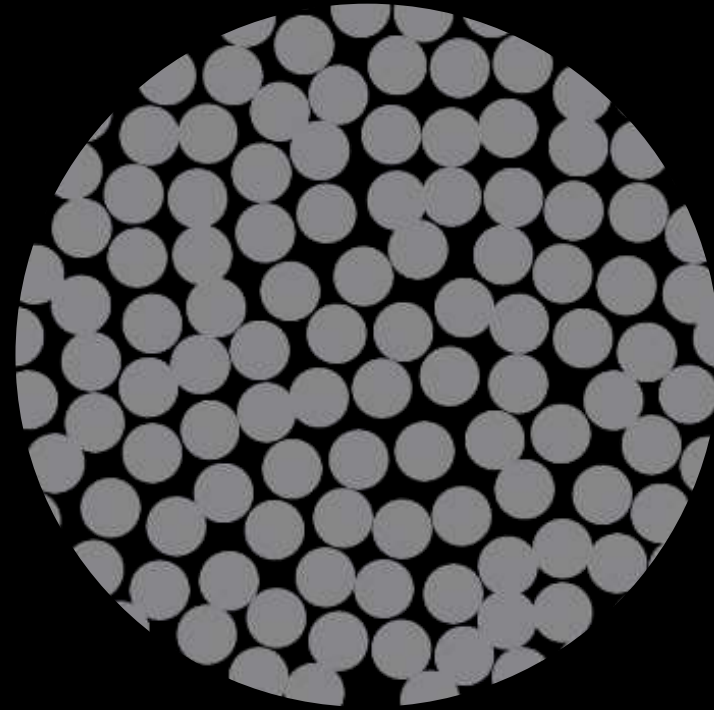
Classes of photonic pigments

Periodic organisation



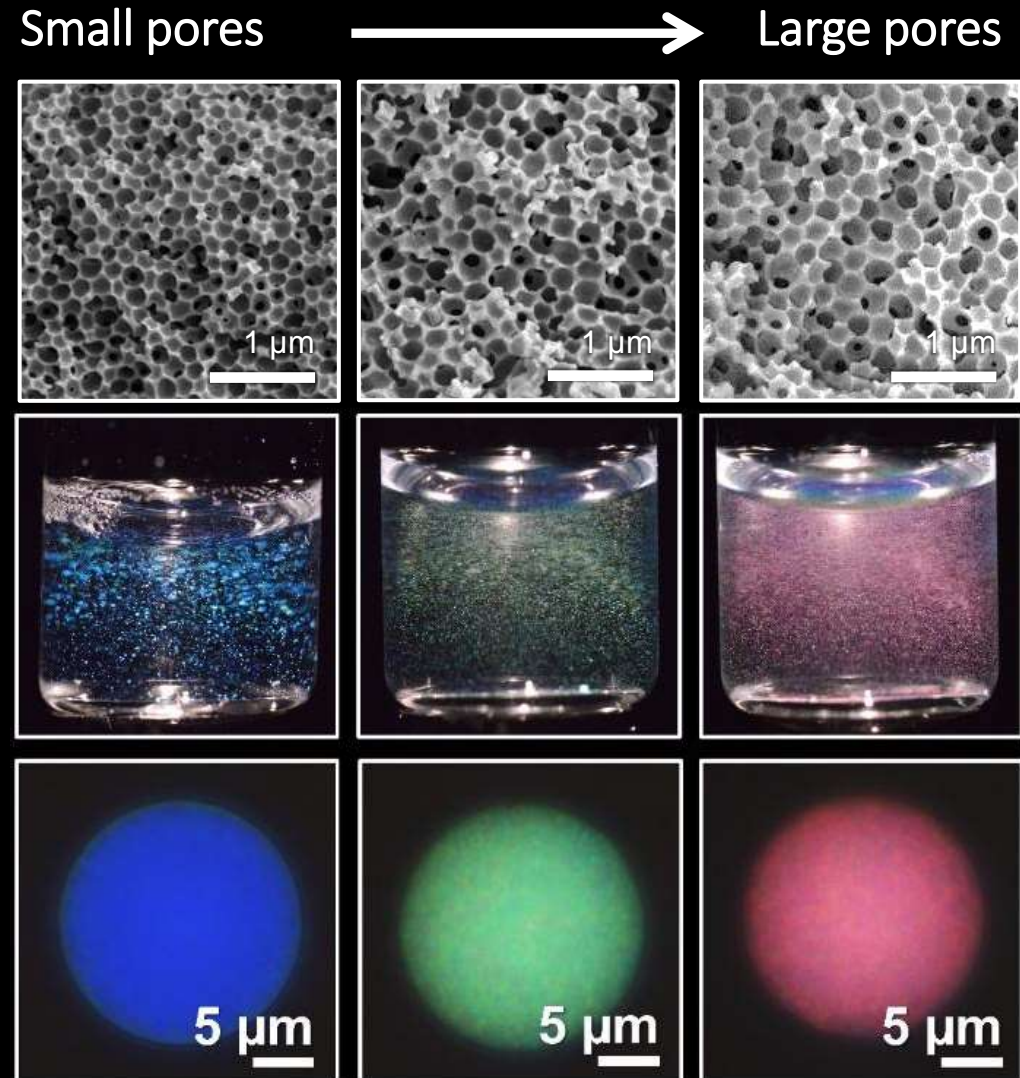
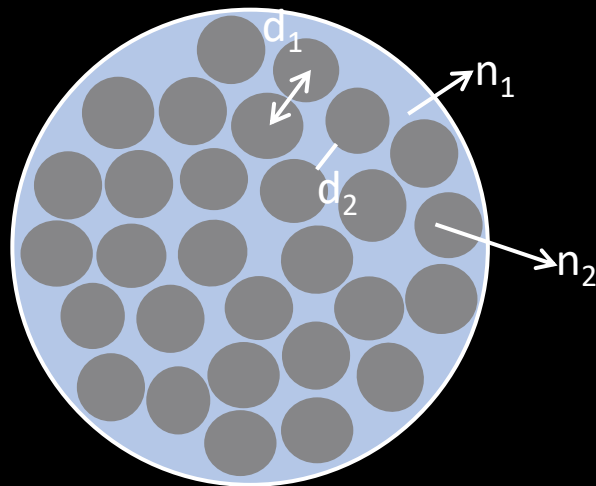
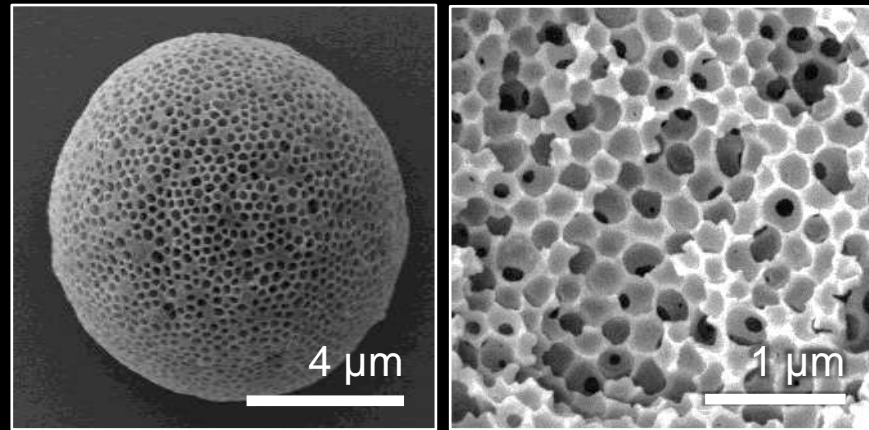
Photonic crystal

Short range correlation

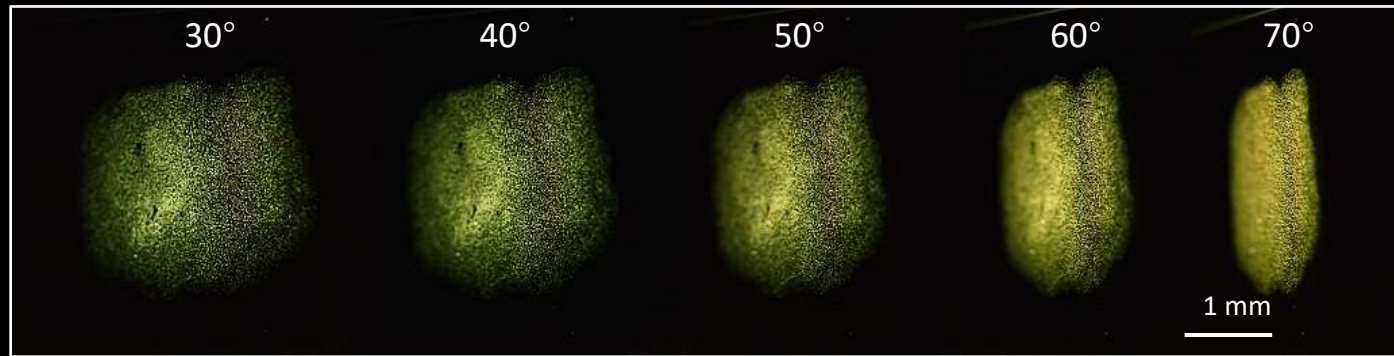
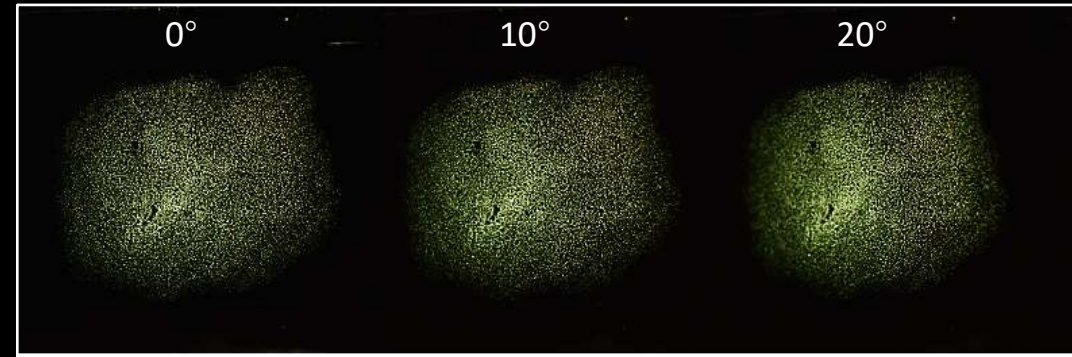
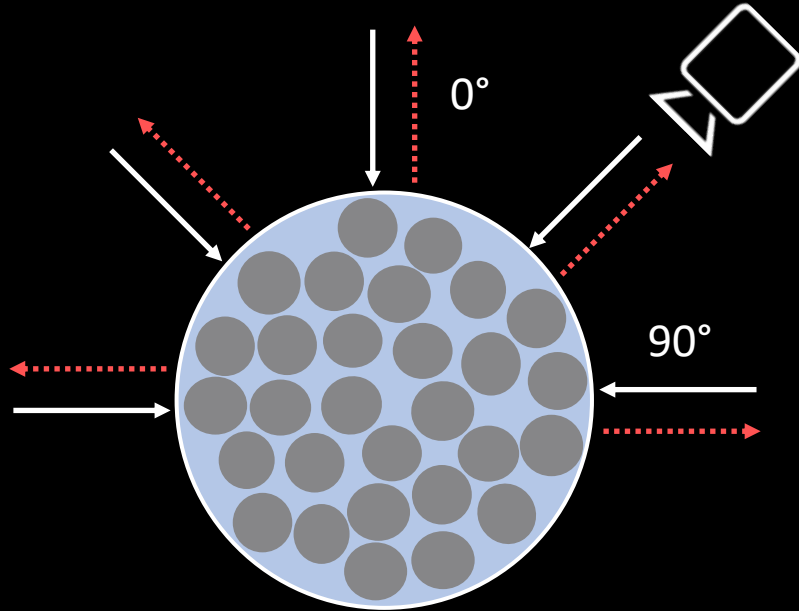


Photonic glass

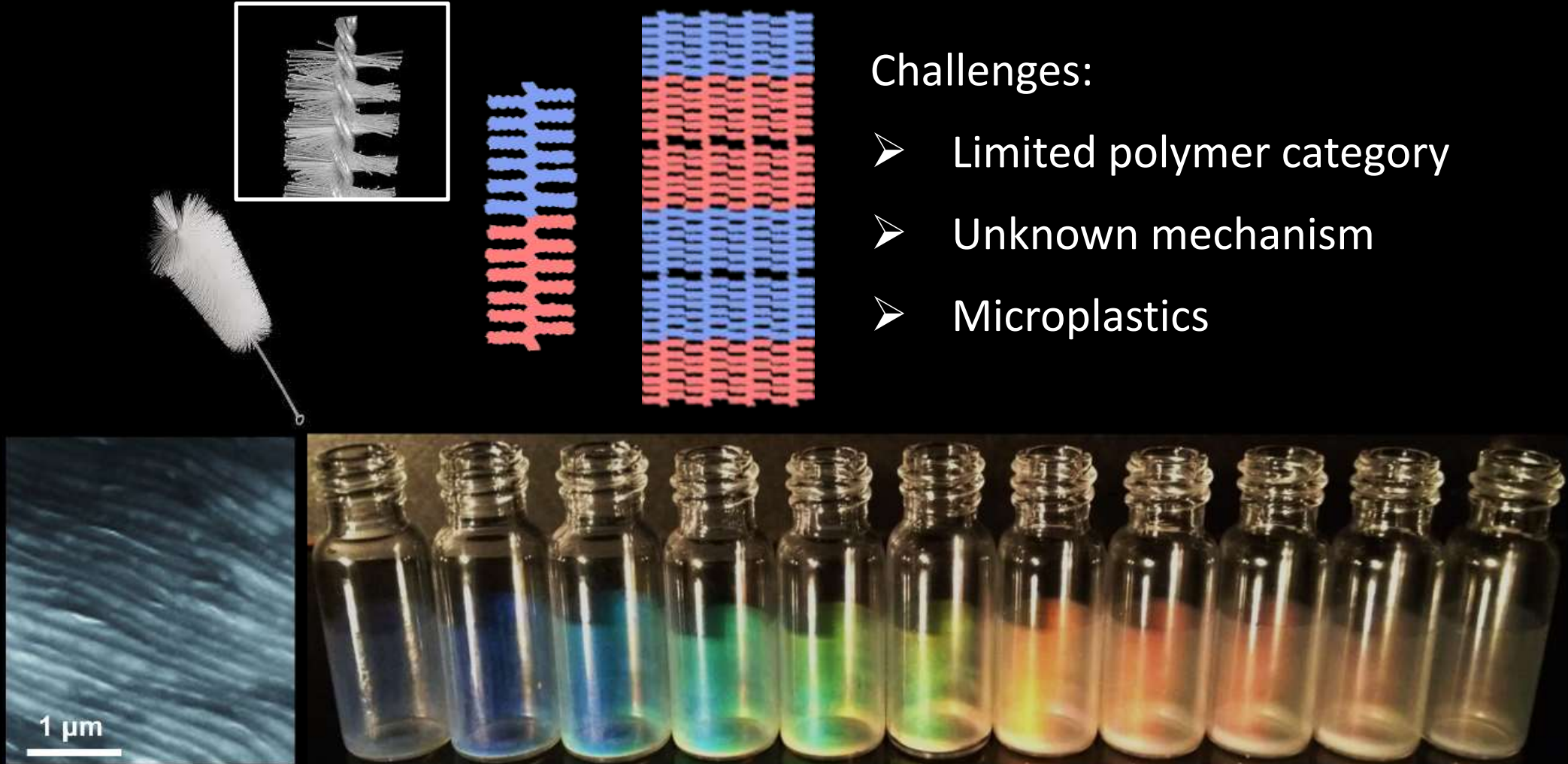
Colour of photonic glass



Angle independence of photonic glass



Challenges



Challenges:

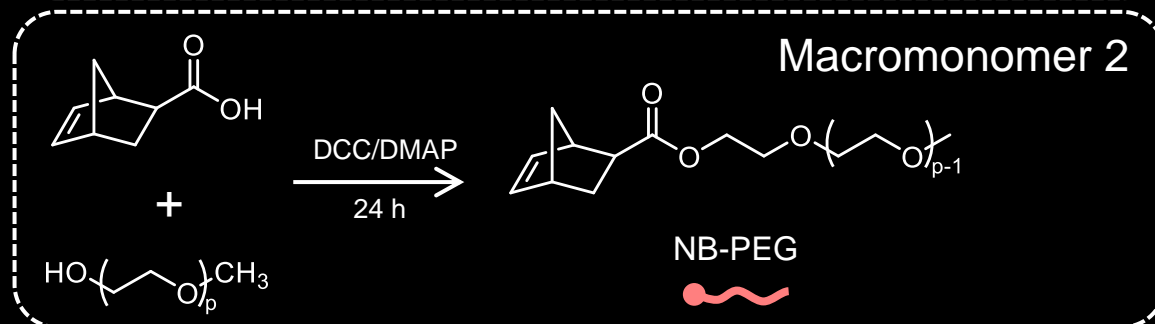
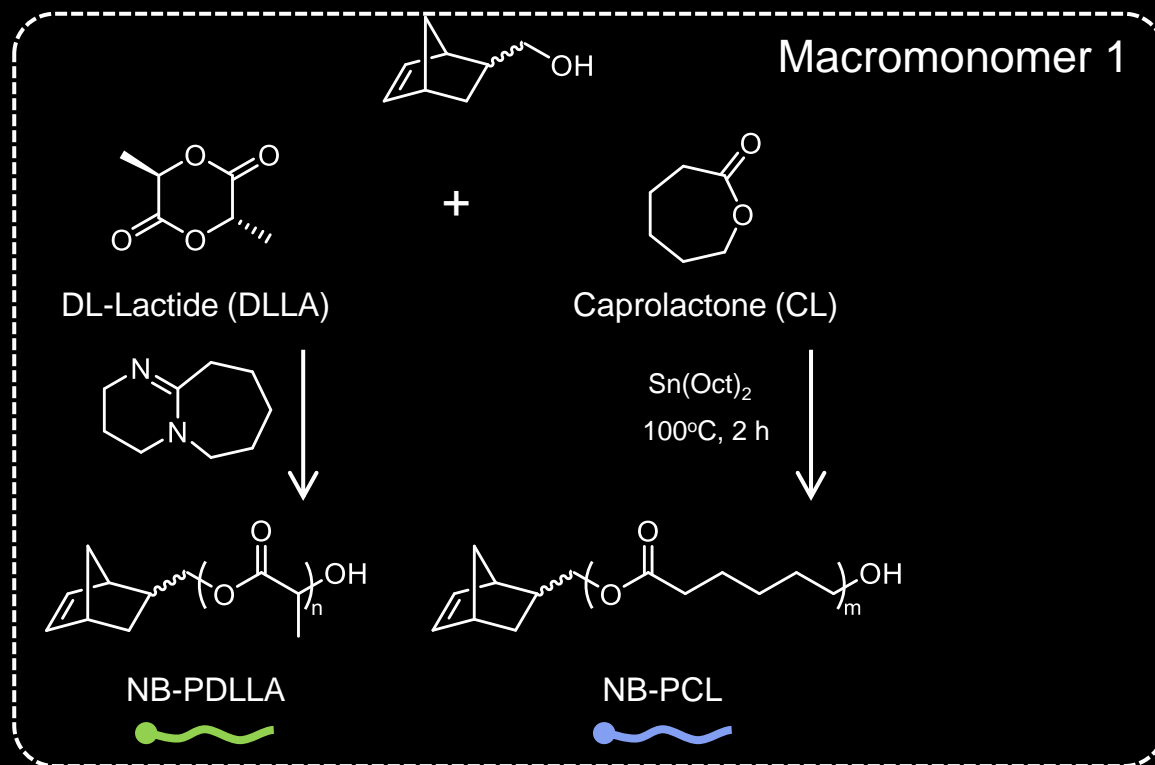
- Limited polymer category
- Unknown mechanism
- Microplastics

Review: Z. Wang *et al.*, *Angew. Chem. Int. Ed.* **2022**, *61*, e202117275.
G. M. Miyake, *et al.*, *Angew. Chem. Int. Ed.* **2012**, *51*, 1124.

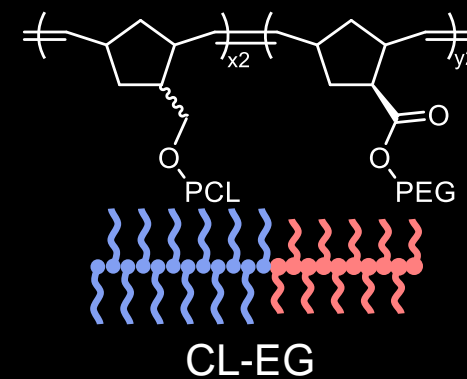
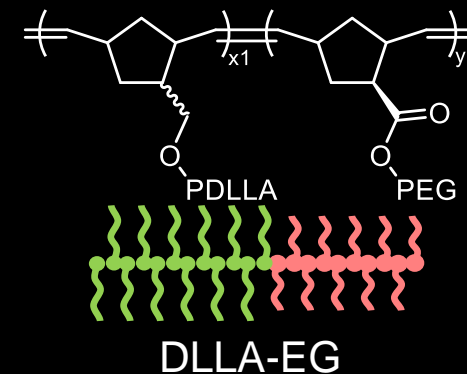
Outline

1. Synthesis of sustainable BBCPs
2. Formation mechanism of photonic glass
3. Wavelength and colour purity tuning

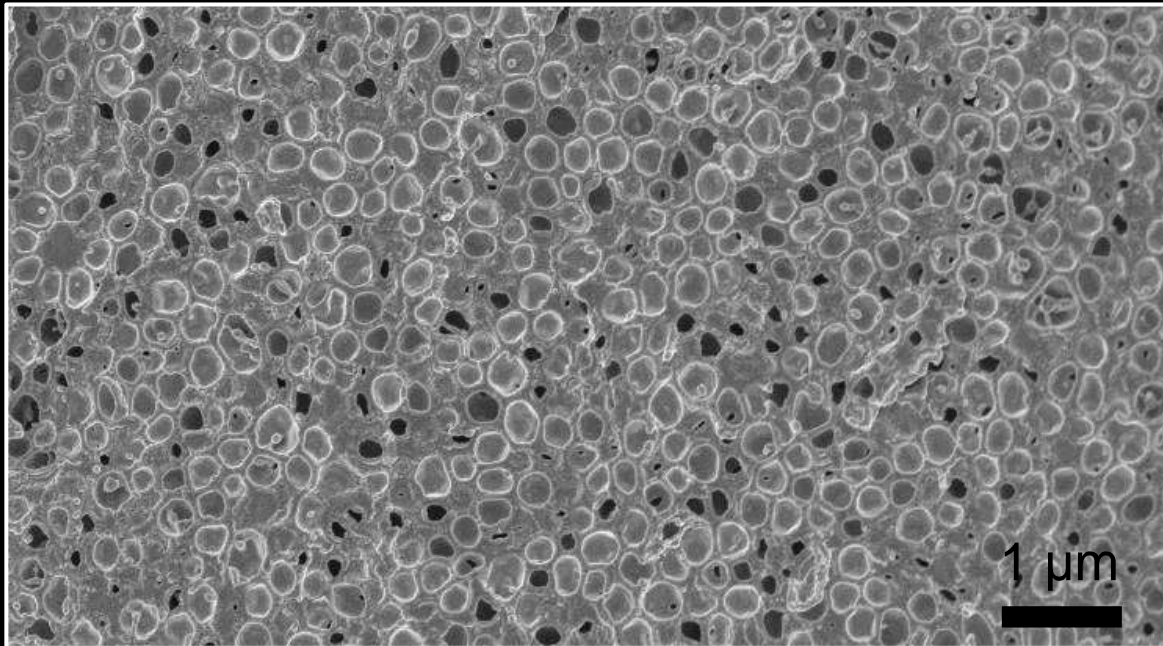
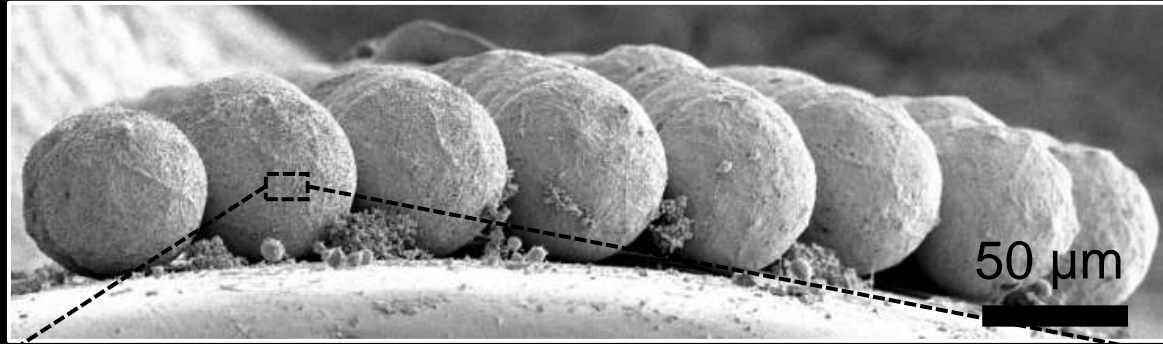
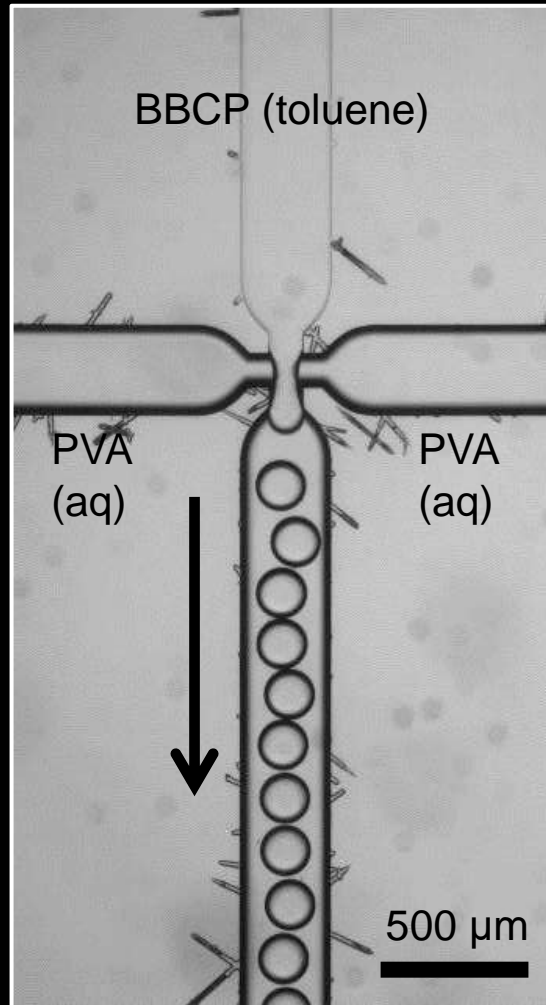
Sustainable BBCPs



ROMP
(i) G3
(ii) EVE



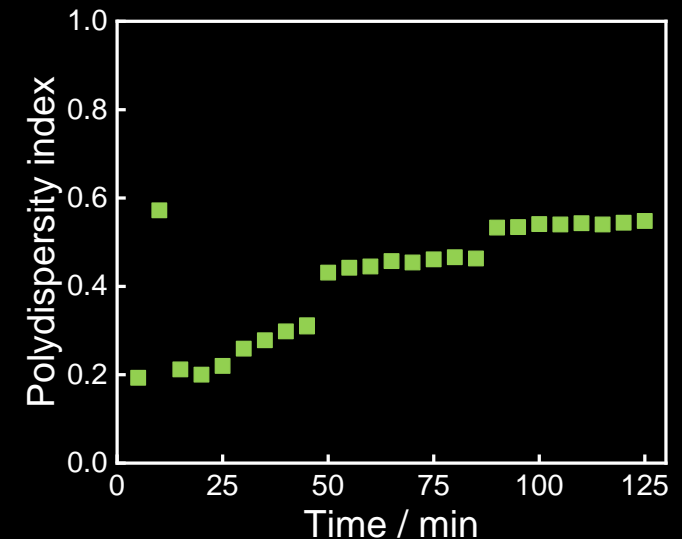
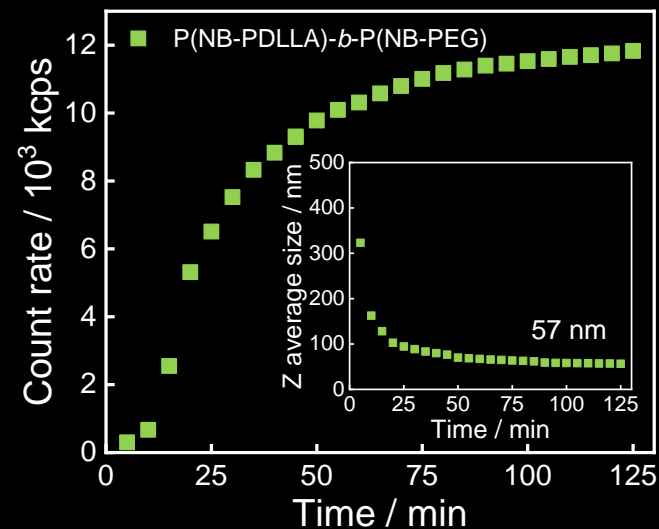
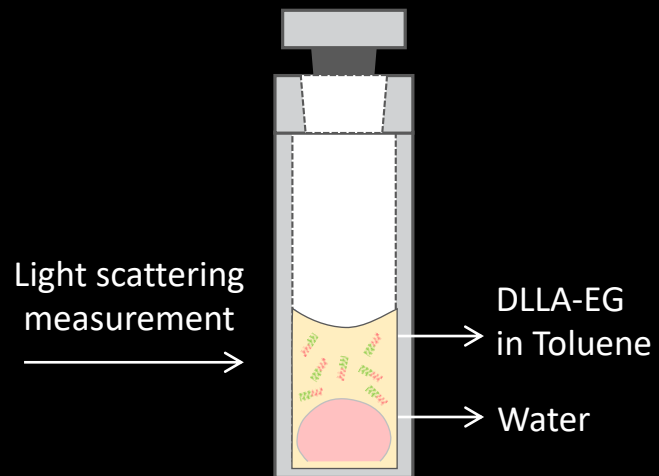
BBCP microspheres



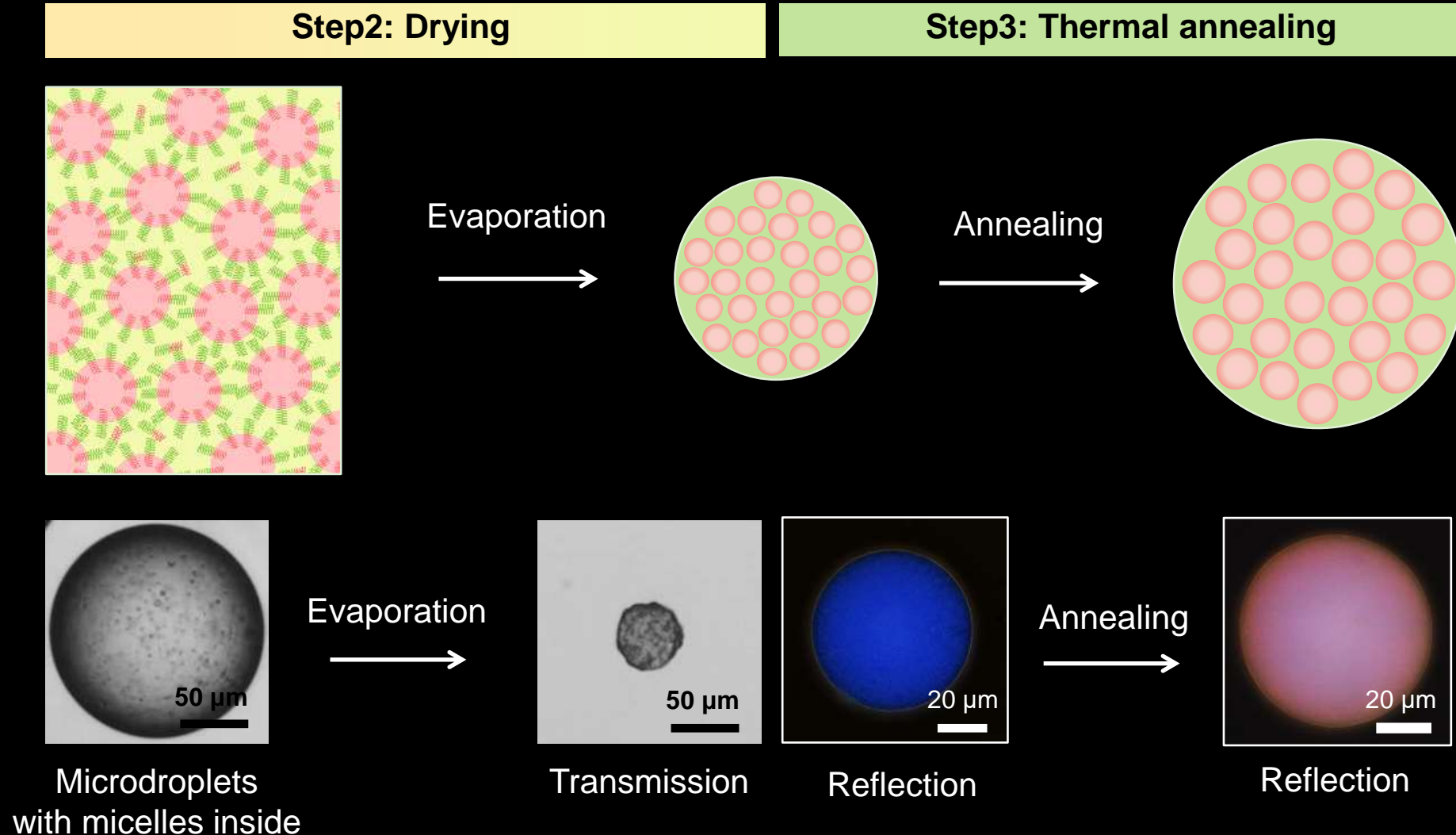
The microparticles have typical photonic glass architecture.

Formation of photonic glass

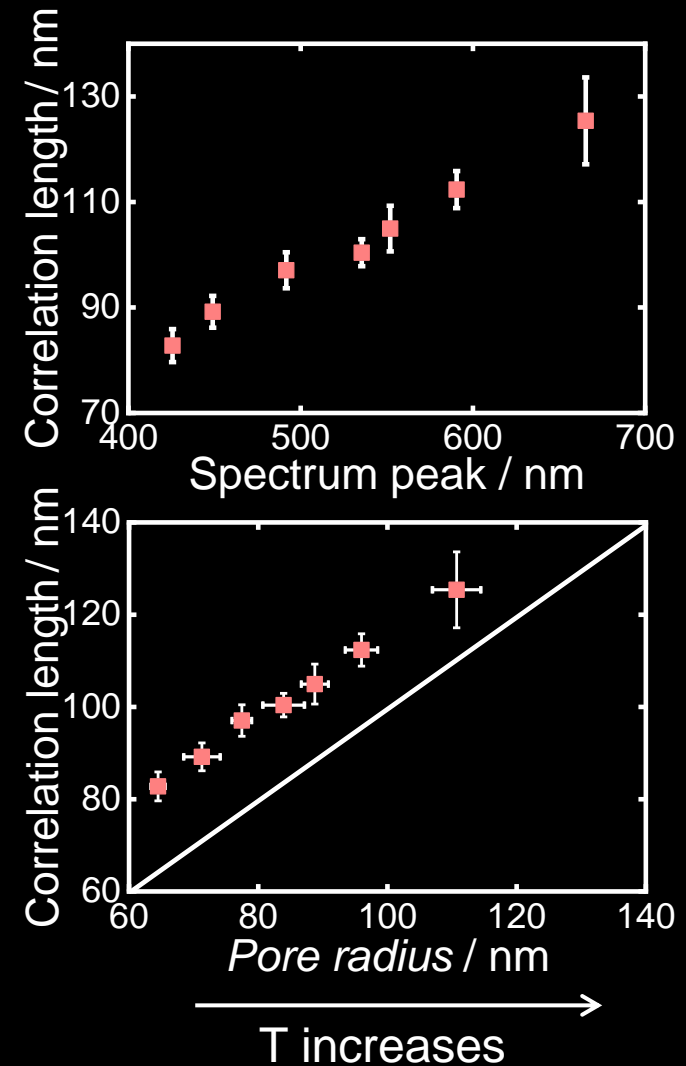
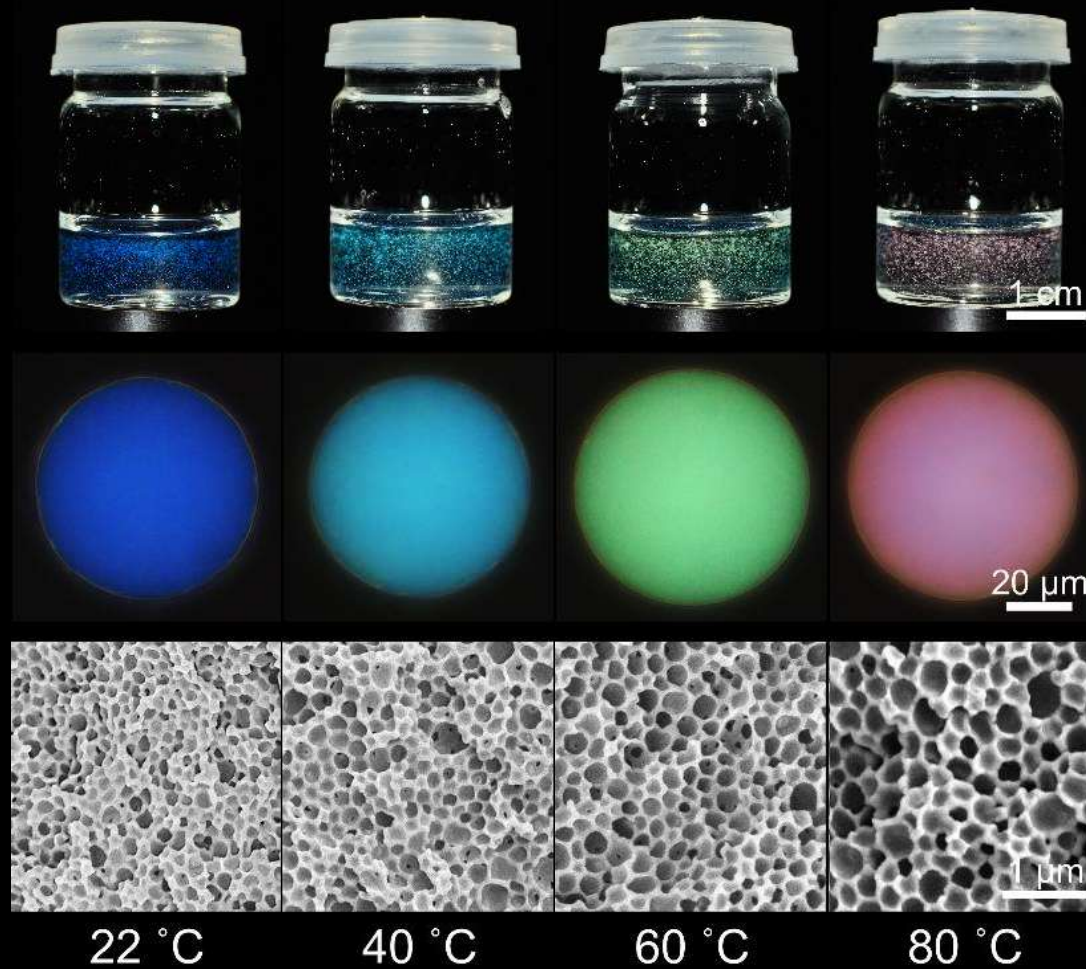
Step1: Micellisation



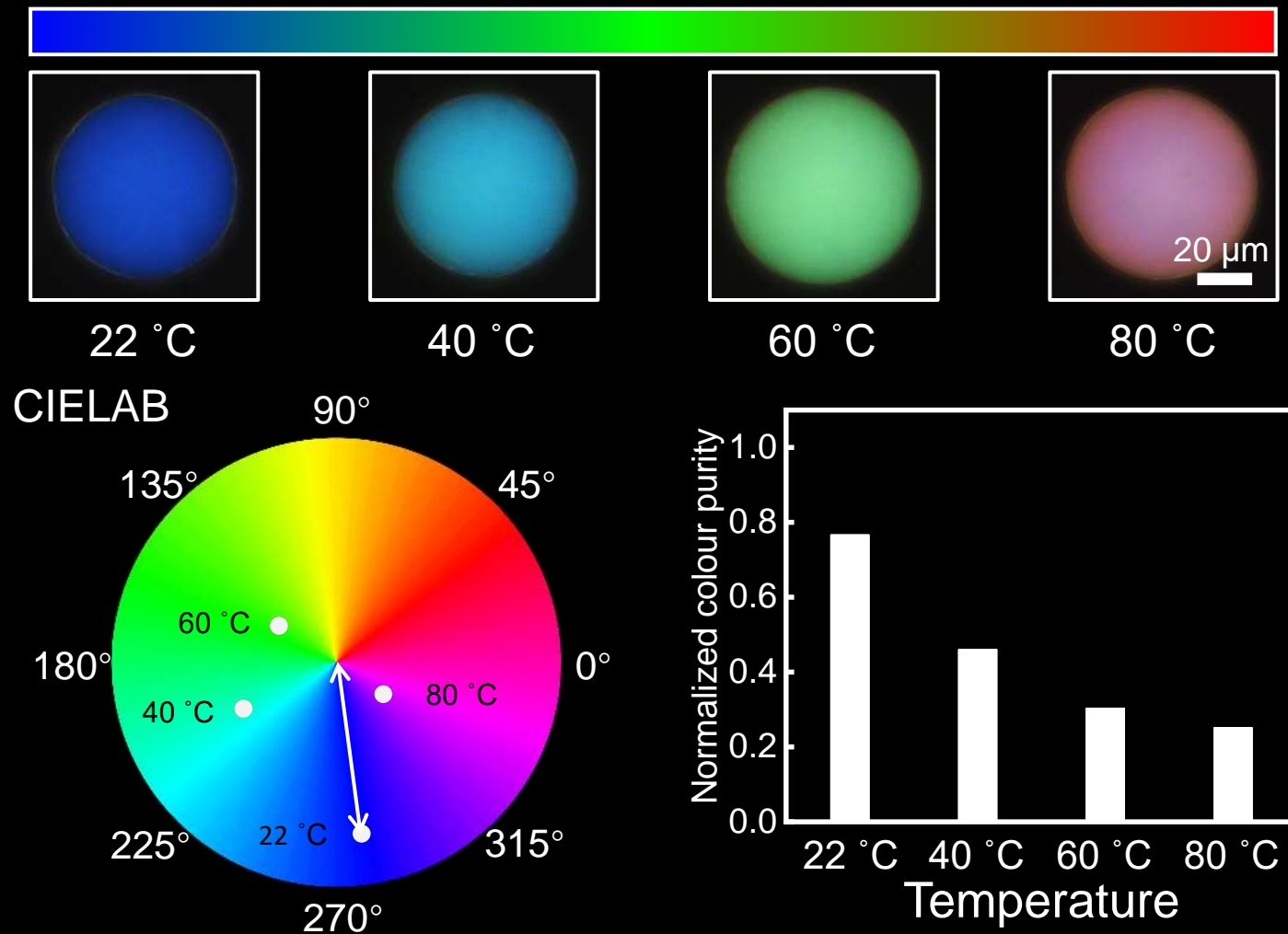
Thermal annealing of photonic glass



Wavelength tuning

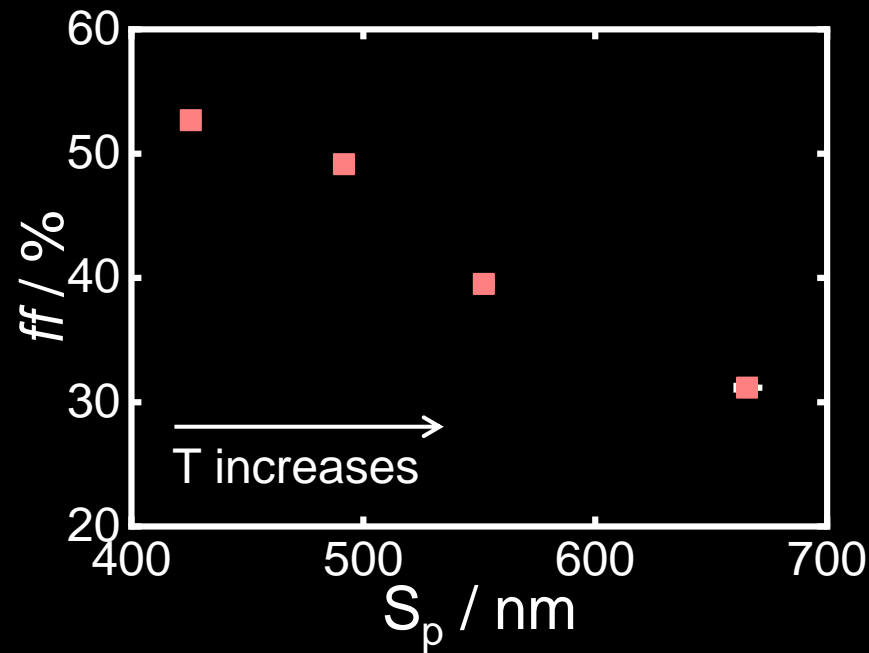
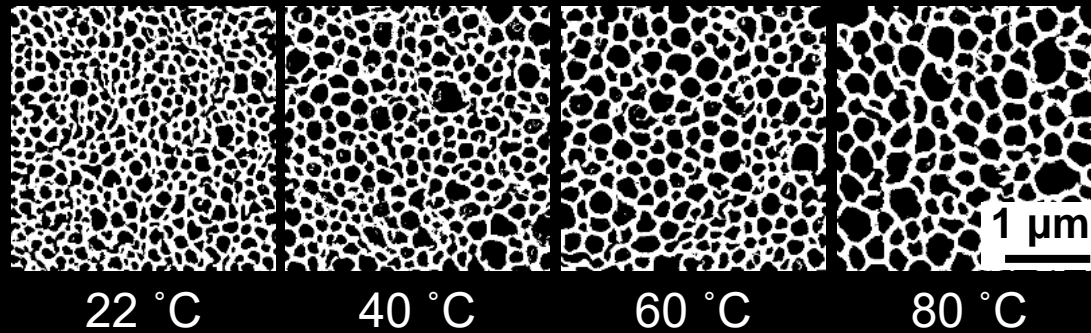


Colour purity

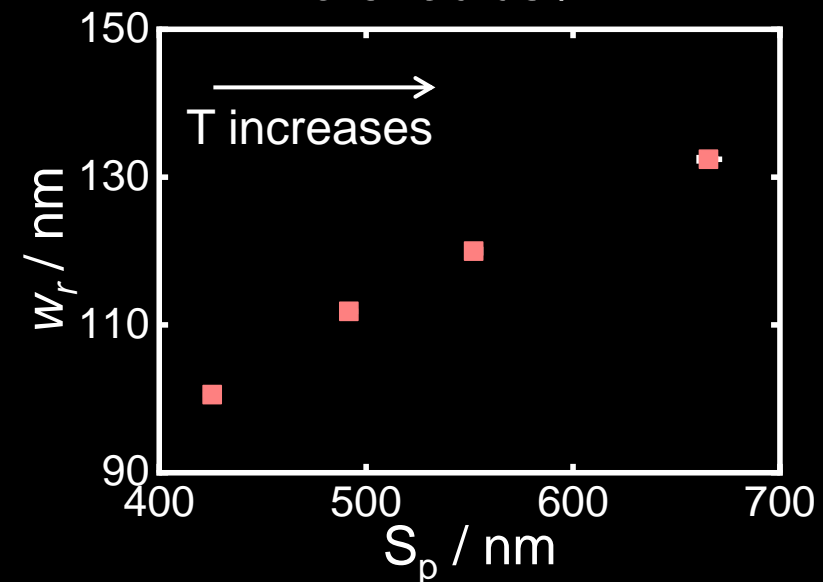
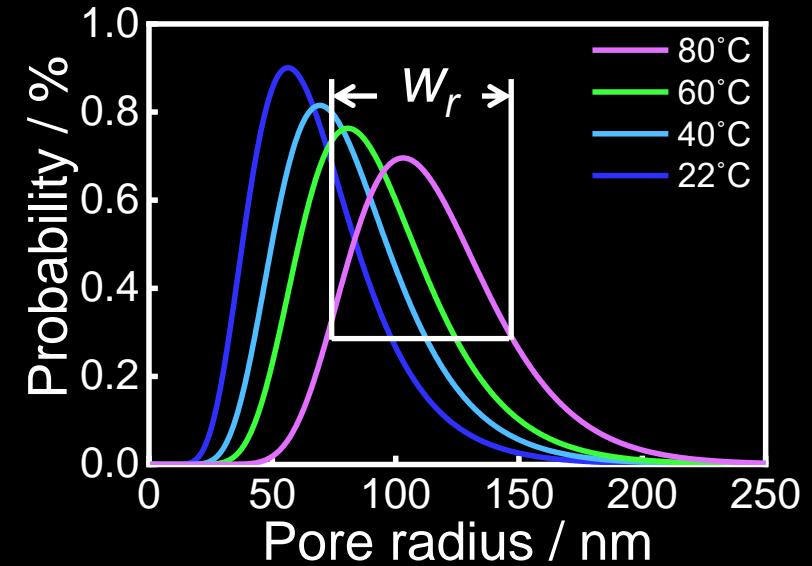


The colour purity decreases as temperature increases.

Factors affecting the colour purity



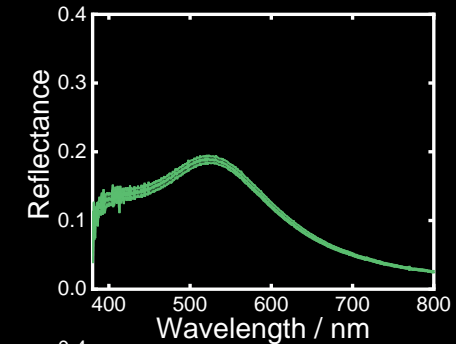
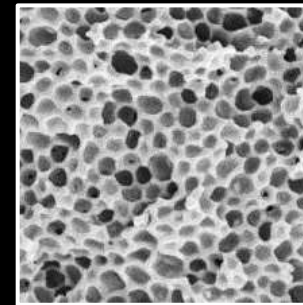
High ff and low w_r give high colour purity!



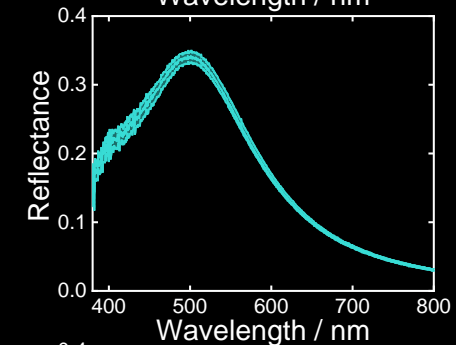
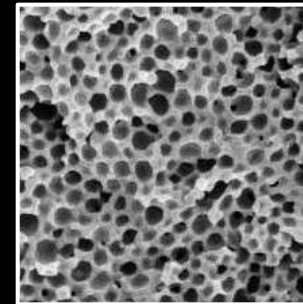
How to improve colour?

Blending macromonomer increase ff and lower w_r , but lower ξ

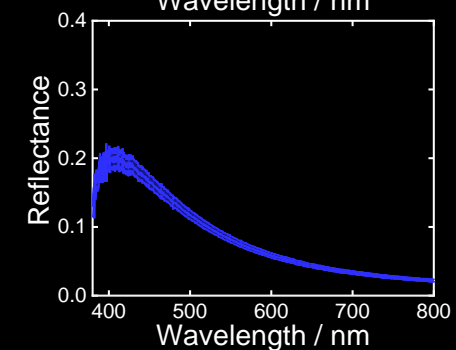
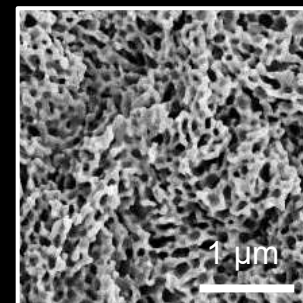
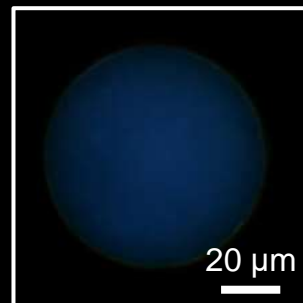
50 °C
 $ff - w_r$
42% - 114 nm



50 °C + 40% MM
 $ff - w_r$
52% - 89 nm

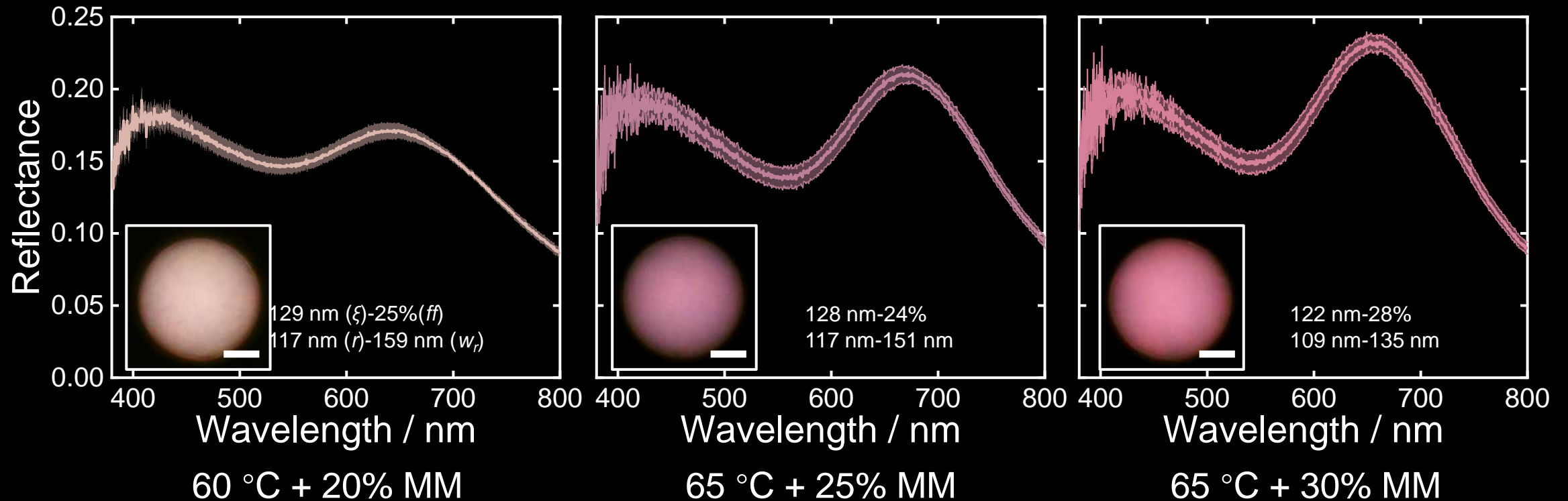


50 °C + 80% MM
 $ff - w_r$
N/A - N/A

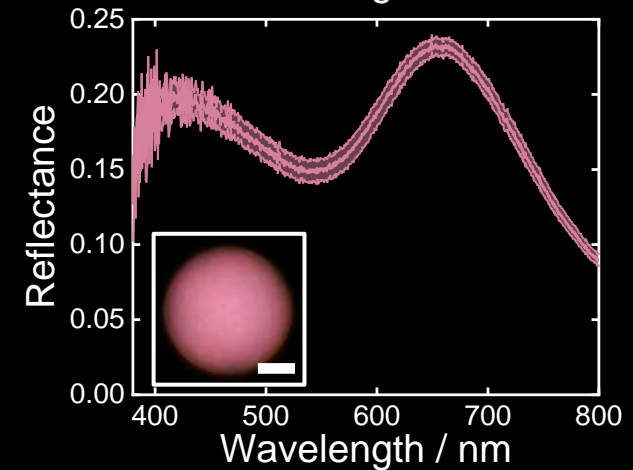
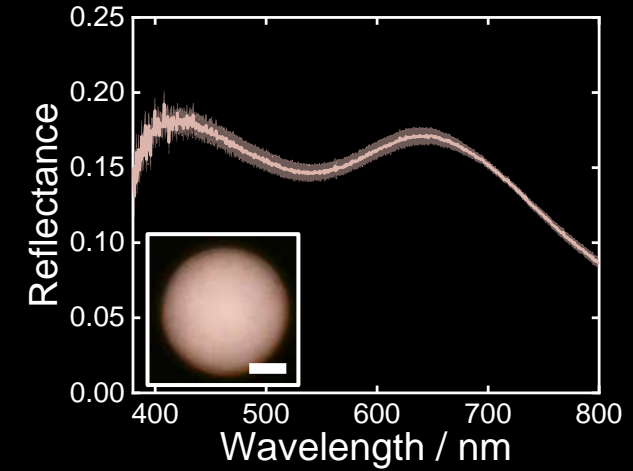
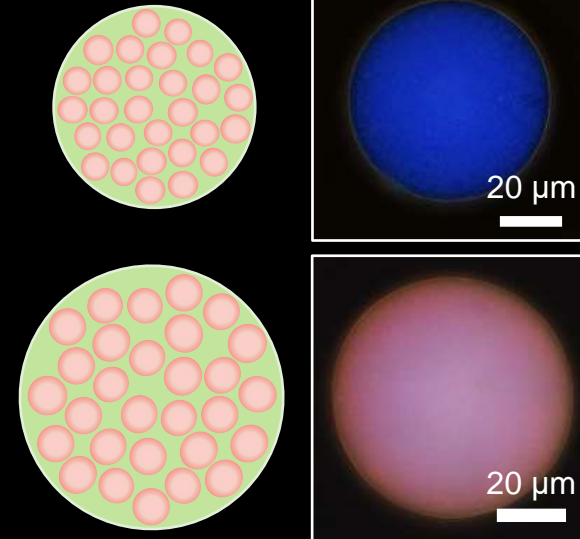
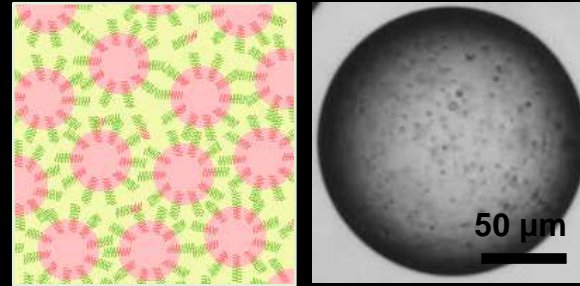
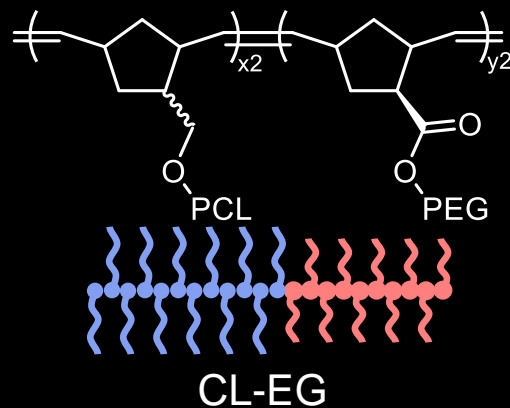
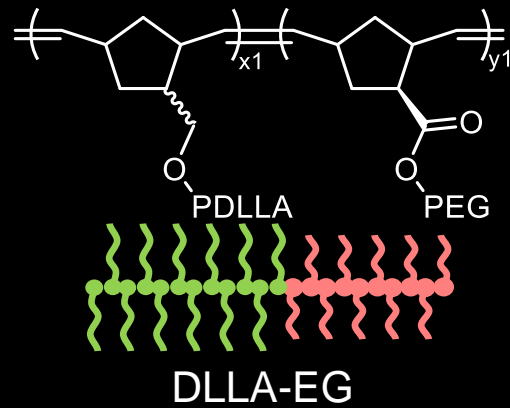


Combined strategy - T and MM

T - redshift reflection and decrease colour purity
MM - blueshift reflection and increase colour purity



Summary



Expand the category of sustainable BBCPs

Three steps: micellisation, drying, thermal annealing

Control filling fraction and polydispersity, better red

Acknowledgements

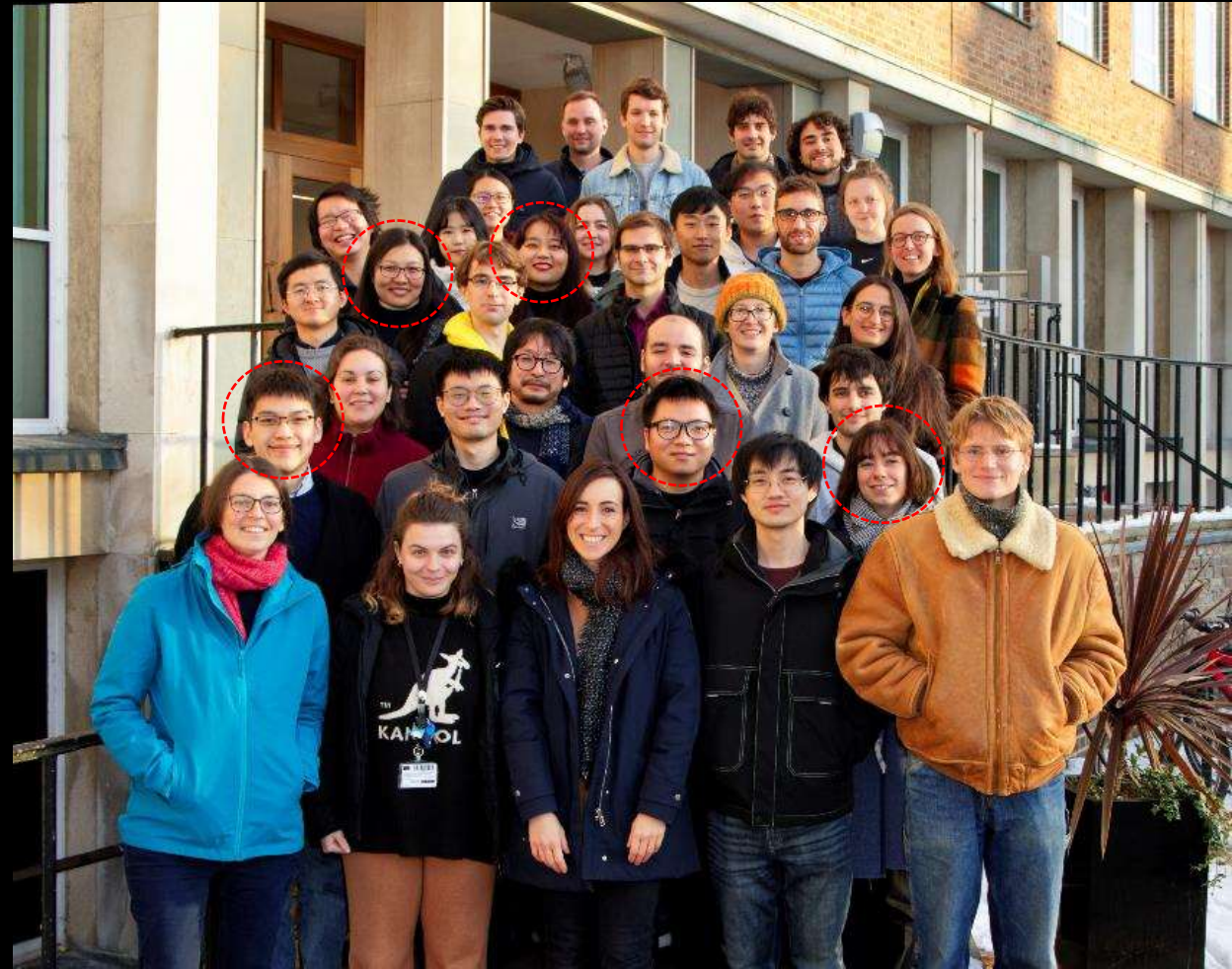


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Dr Lukas Schertel
Dr Yating Zhang
Dr Gea van de Kerkhof
Dr Kui Yu
Prof Oren Scherman



Join us!



We are now in Max Planck Institute of Colloids and Interfaces, Potsdam, Germany!

Website: <https://www.mpikg.mpg.de/sbm>

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Group Leader: Dr Ruiting Li; Email: Ruiting.Li@mpikg.mpg.de