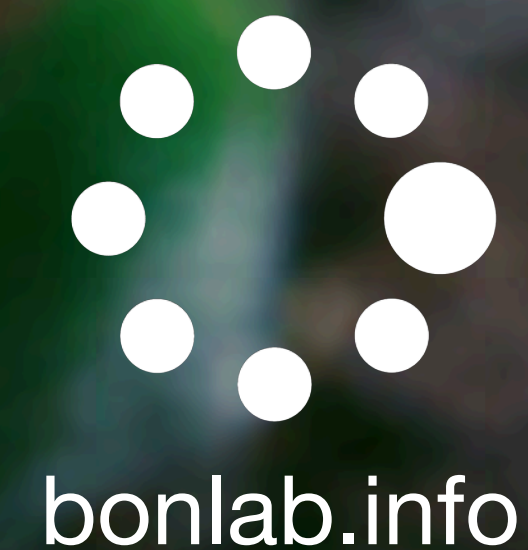


SUPRACOLLOIDAL CHEMICAL ENGINEERING



# #GreenRecovery

TEXTURED MICROCAPSULES THROUGH CRYSTALLIZATION



prof. dr. ir. Stefan A. F. Bon

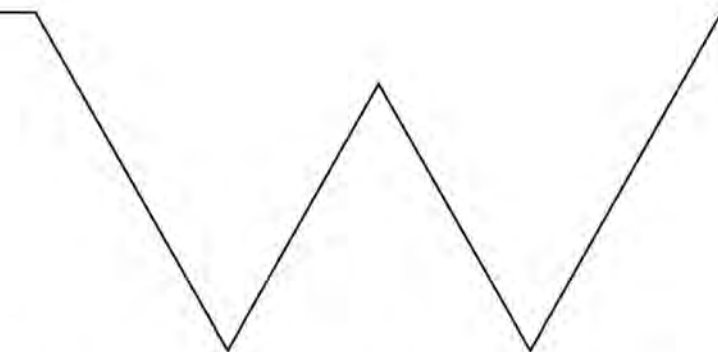
2 March 2021  
Keeping it Green in Personal Care  
Online RSC Webinar





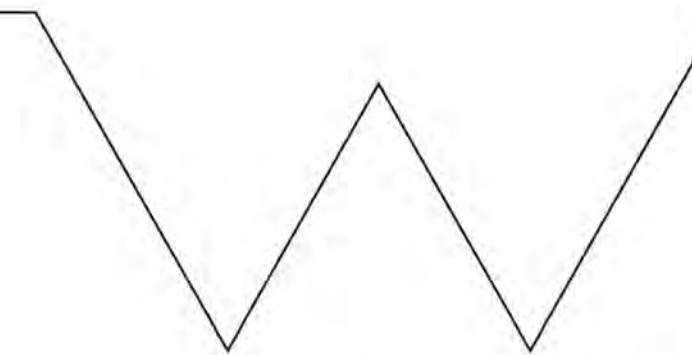
Matt Donald, Josh Booth, Sarah McGinley, Wai Hin Lee, Yuan-Zhi Li, Josh Ryan, Naemah Md Noor, Jamie Rolinski, Douglas Soutar, Emily Brodgen, James Coe, Jack Cartwright, Josh Davies.

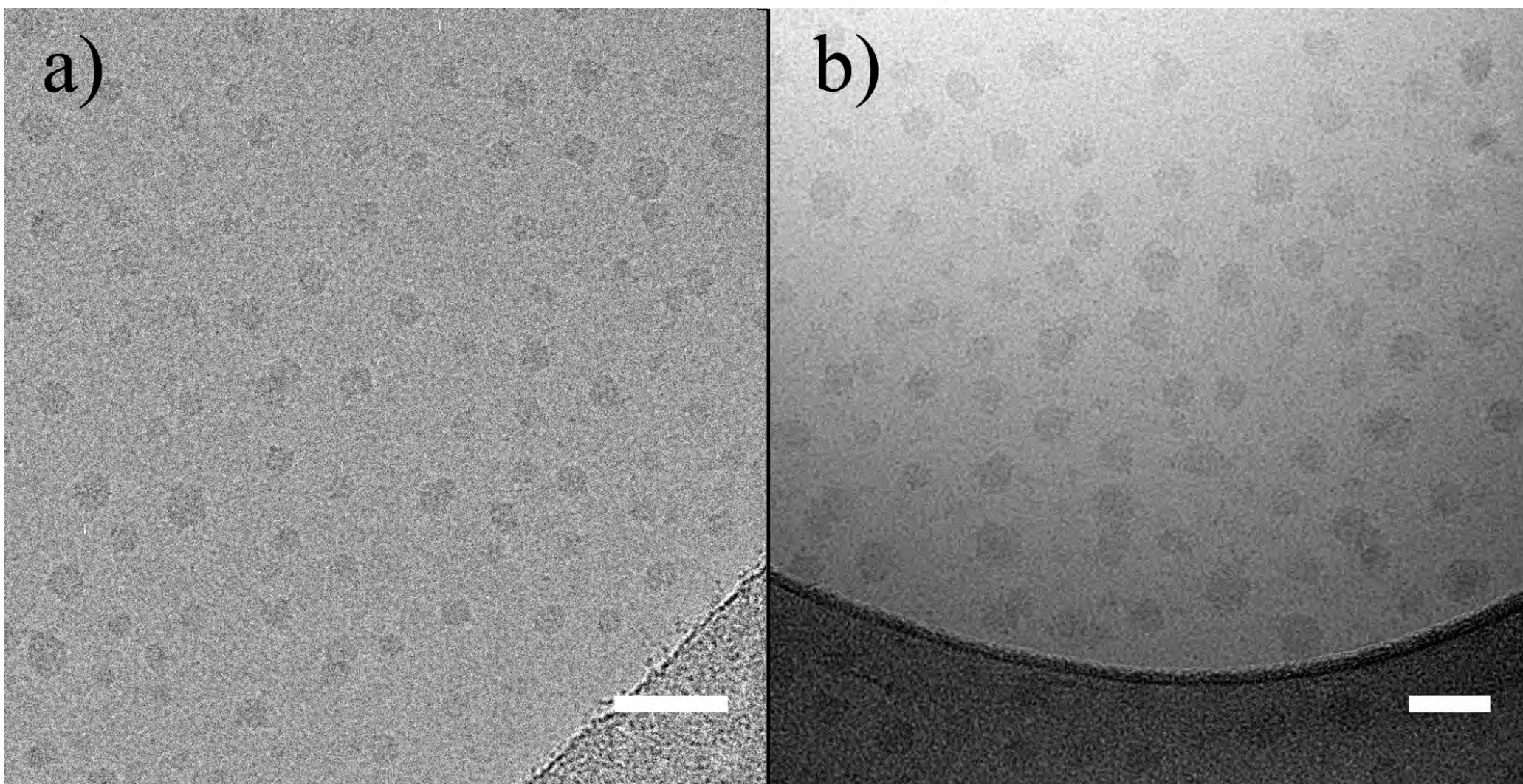
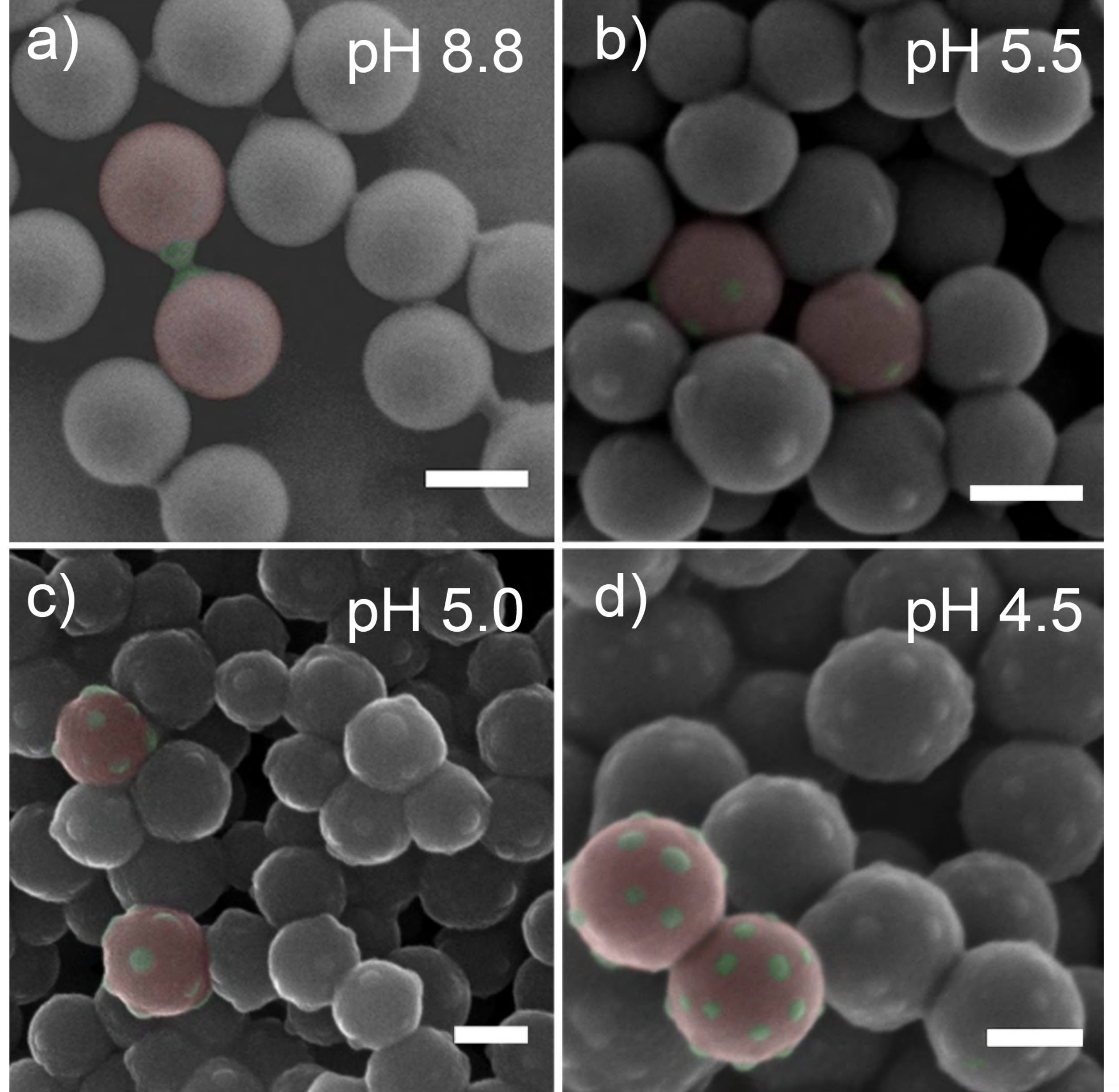
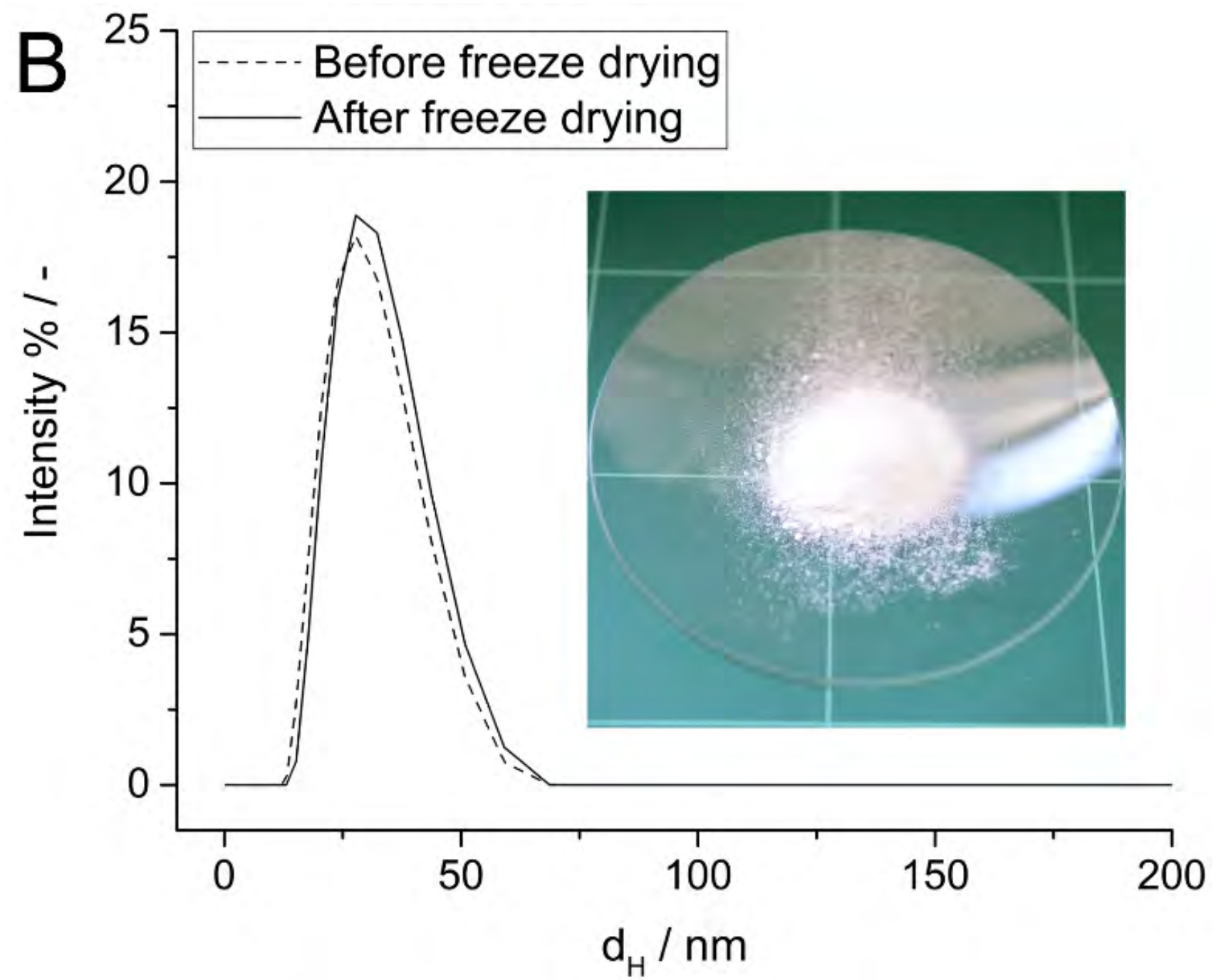
Special thanks to **Sam Wilson-Whitford (4th from left in picture)**, & Ross Jagers, Brooke Longbottom, Guy Clarkson



# Programmable Alginate Hydrogels

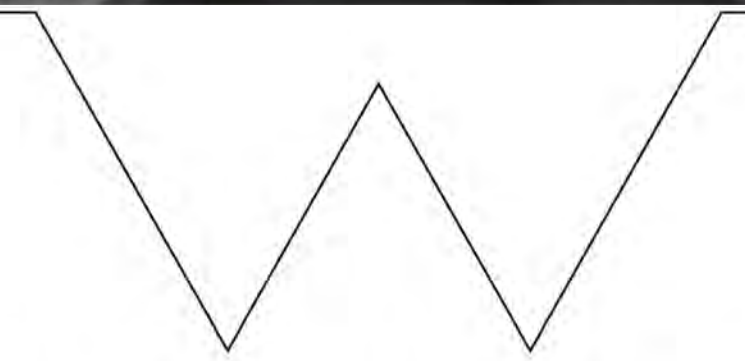
*Mater. Horiz.* **2017**, 4, 402-407. *J. Mater. Chem. B* **2017**, 5, 7491-7495 and 8681-8685.

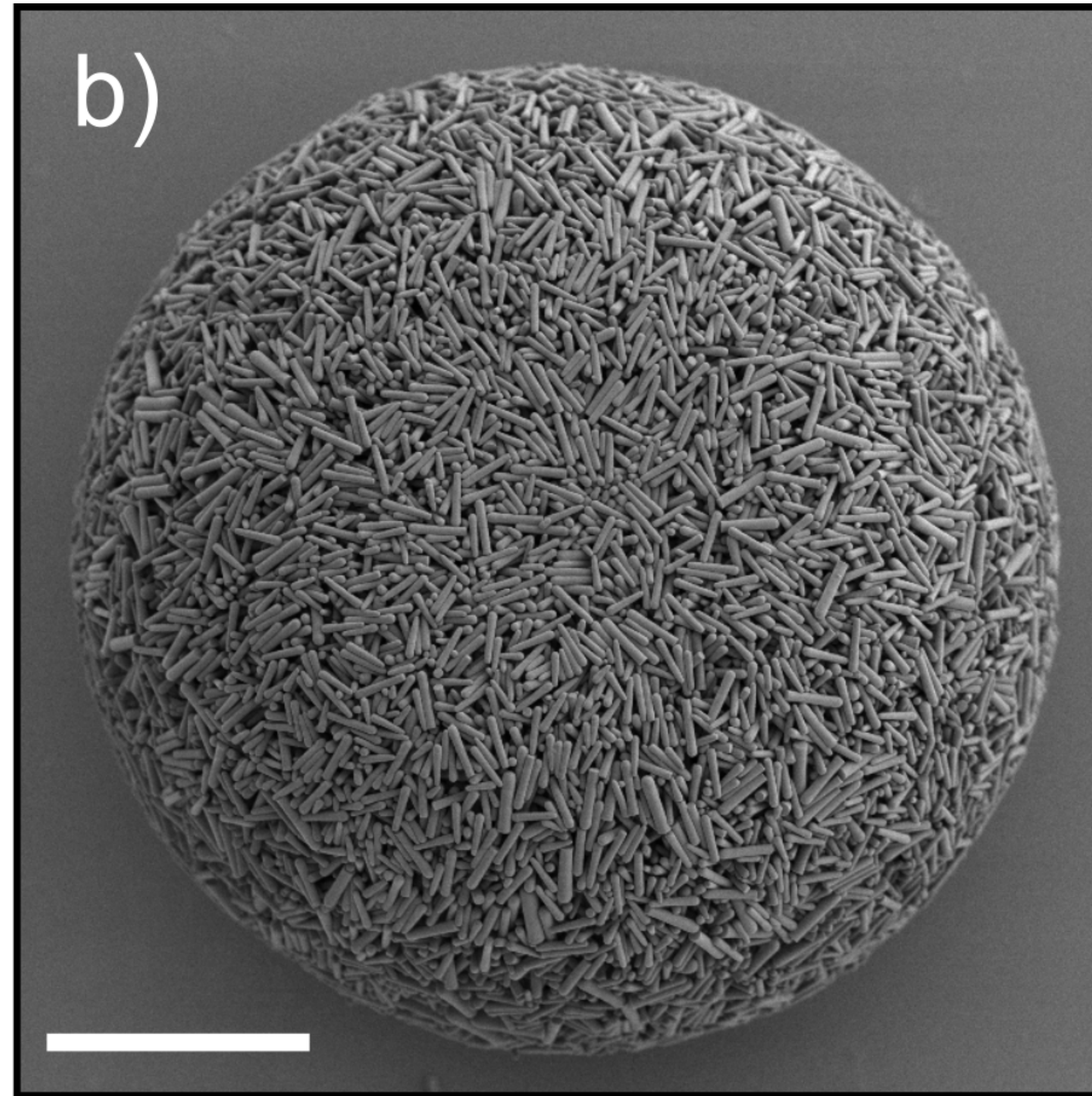
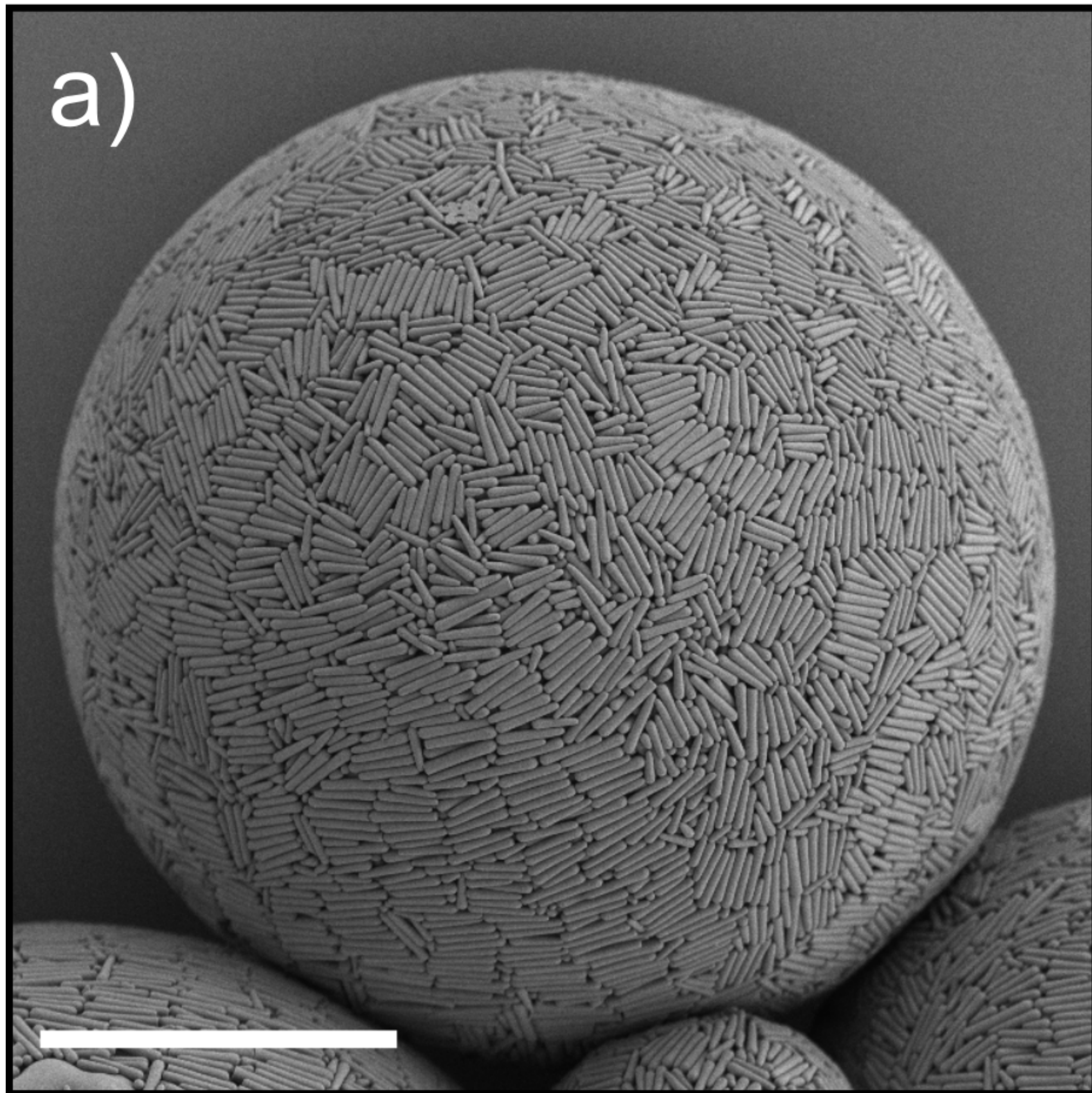




## Nanogels as Surfactants

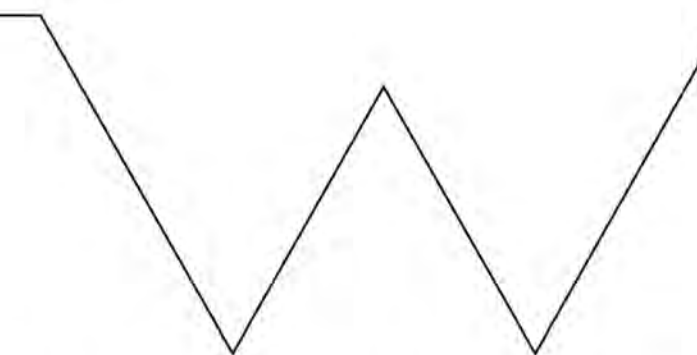
*ACS Nano* **2019**, 13, 399-407. WO2020079416A1.





## Replacing Titanium Dioxide as Opacifier

*J. Mater. Chem. C*, **2021**, Advance HOT Article. <https://doi.org/10.1039/D1TC00072A>



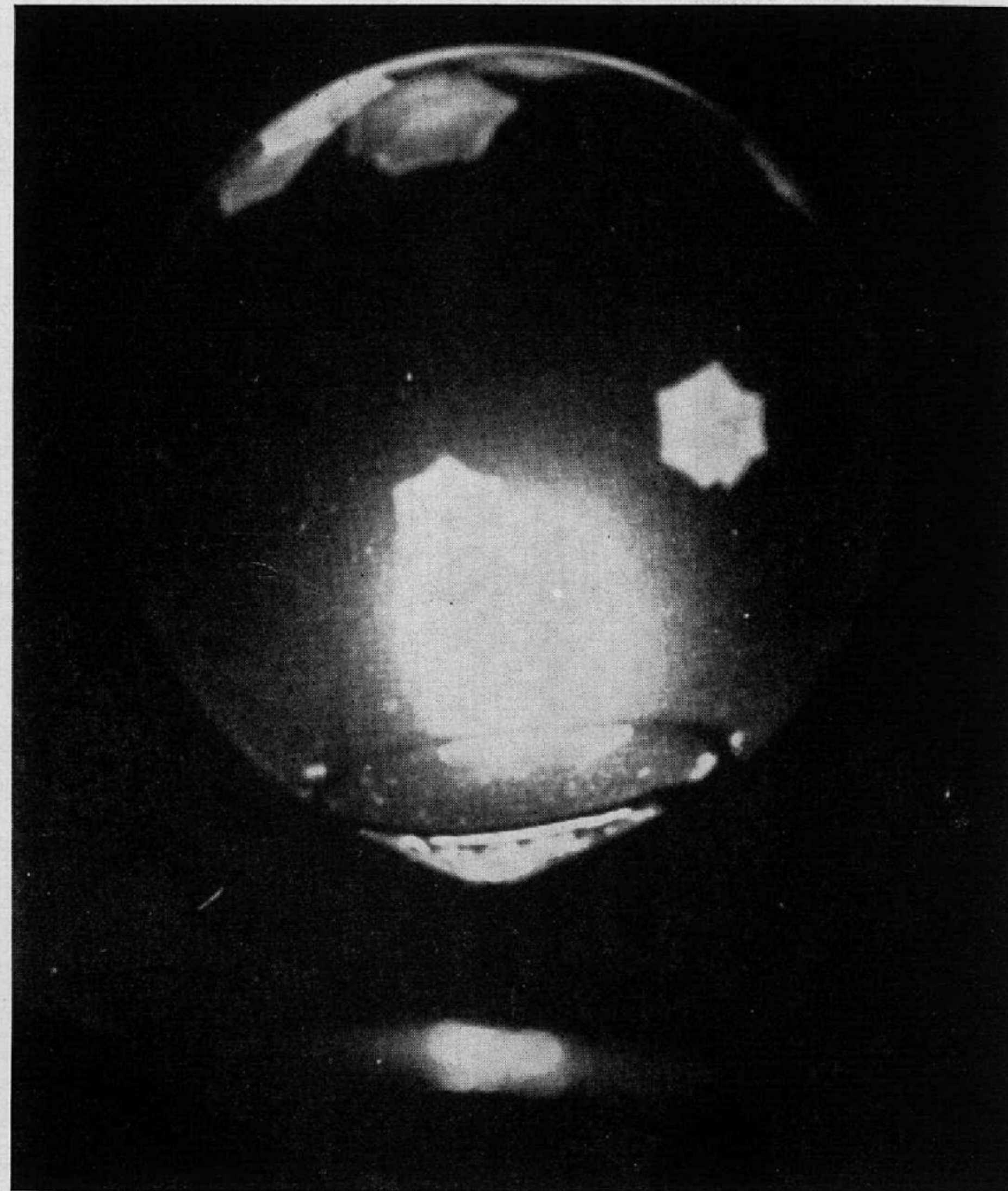
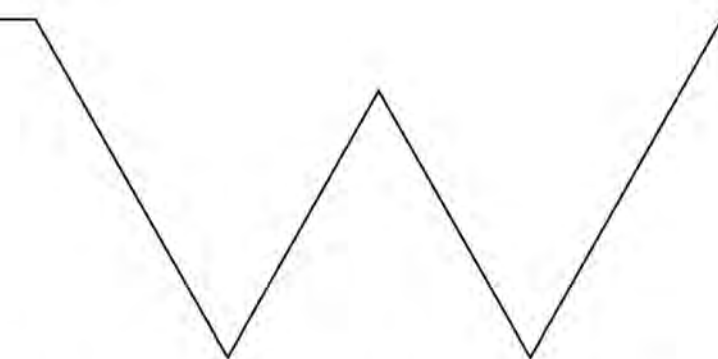
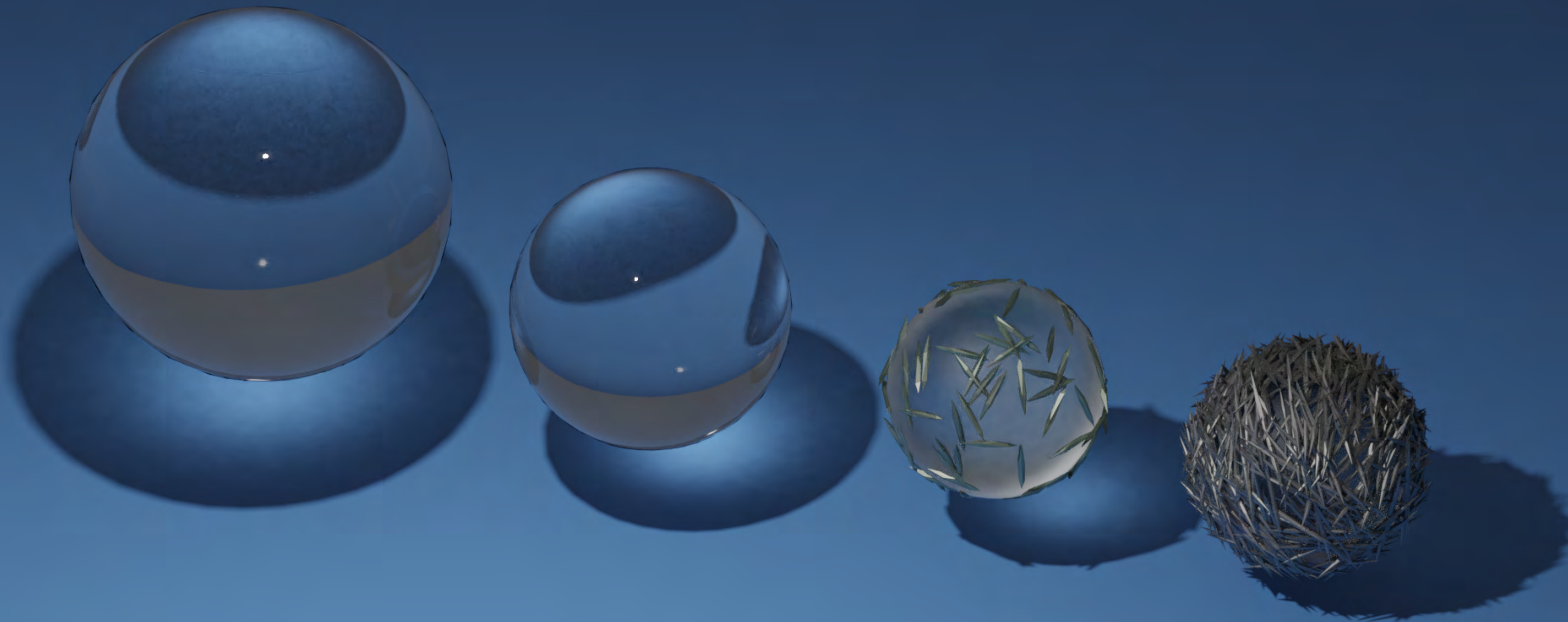
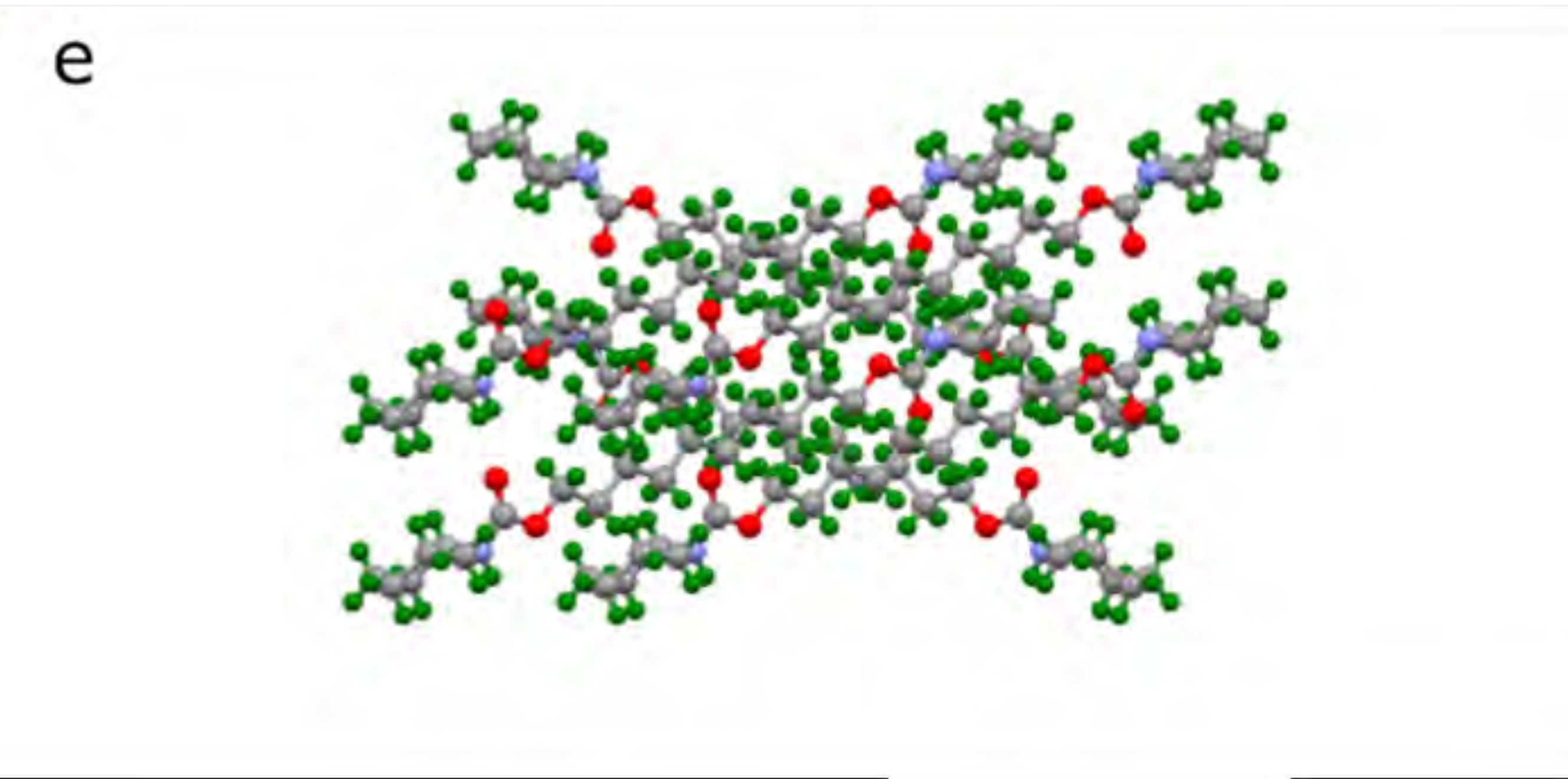
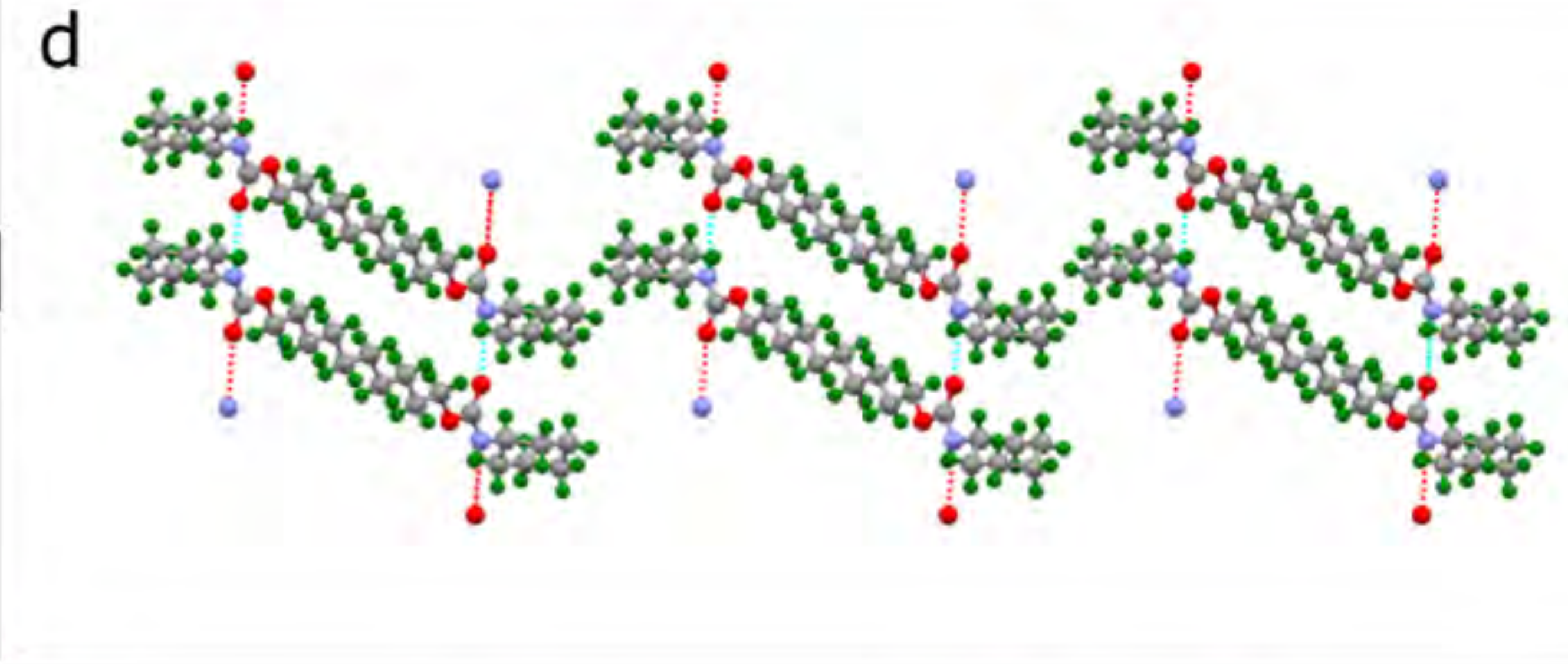
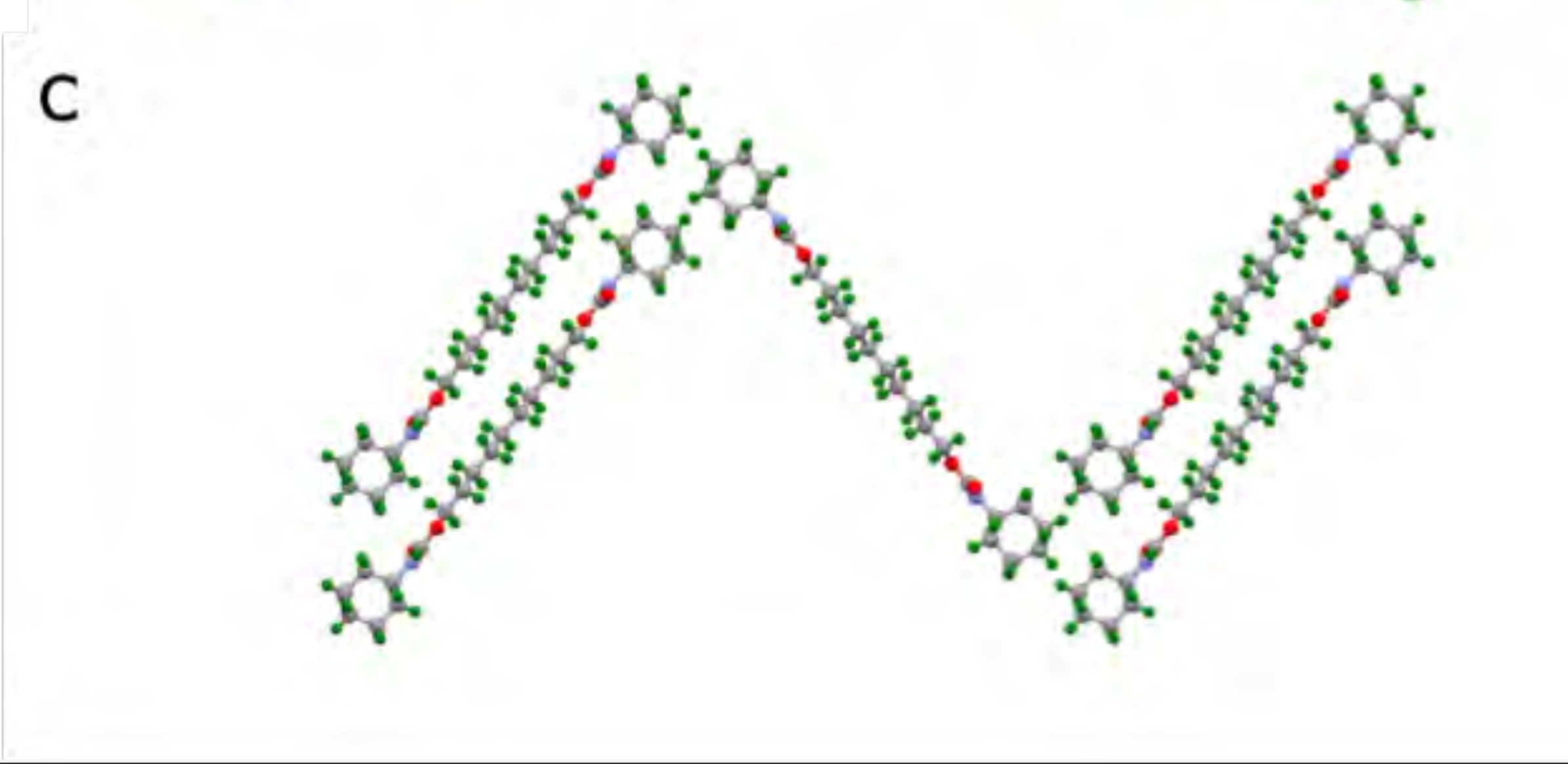
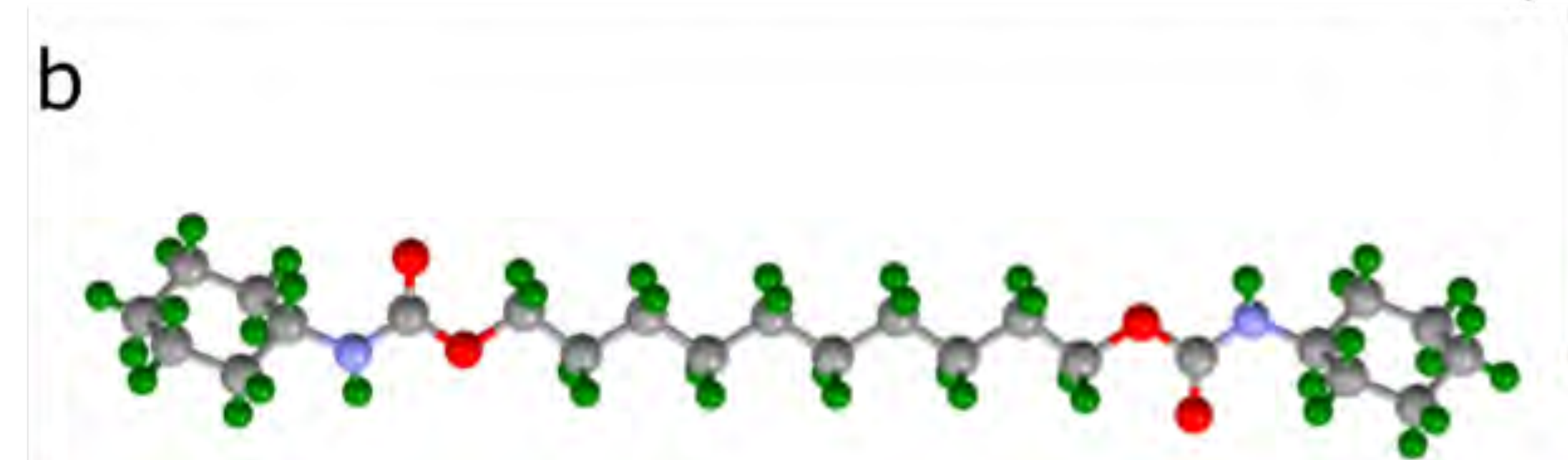
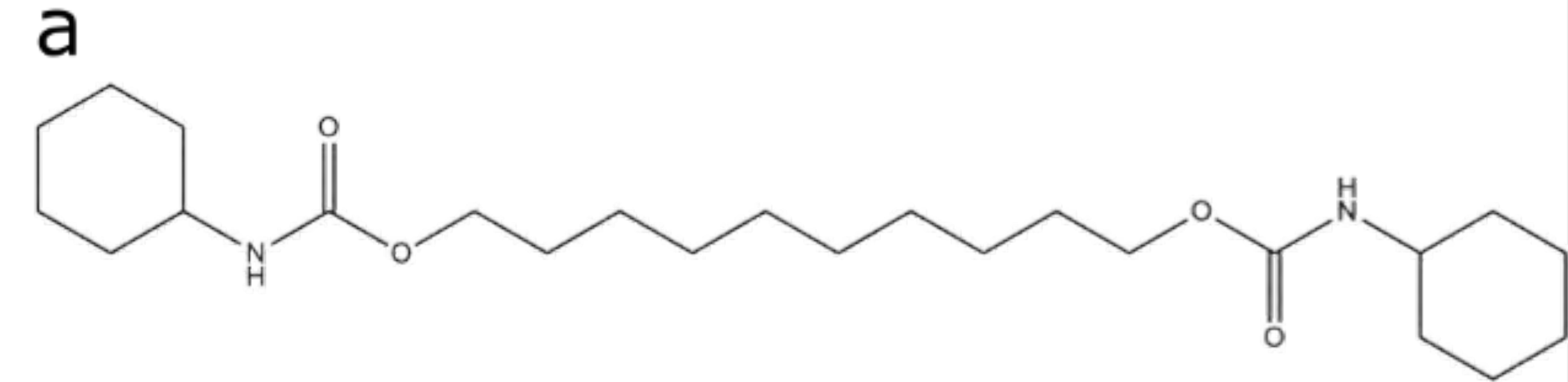


FIG. 13. Supercooled bubble in which ice crystals are growing

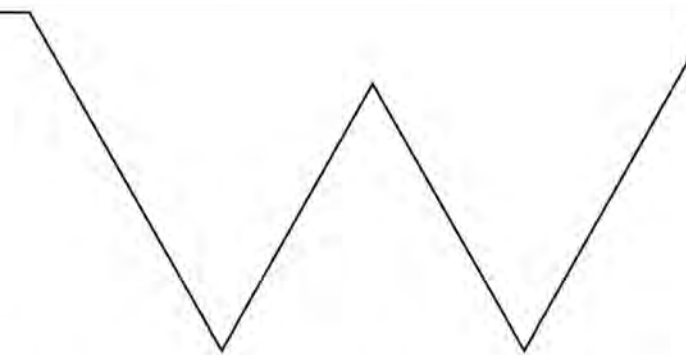




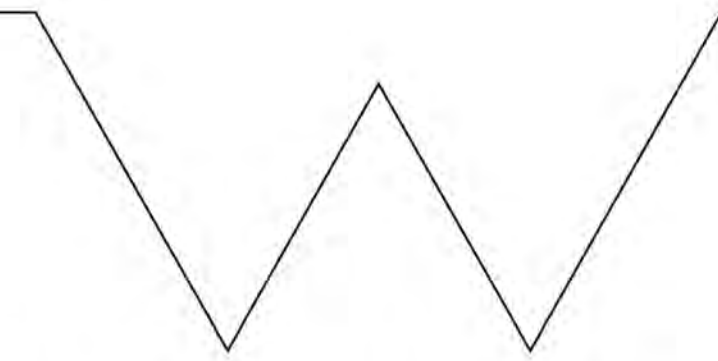
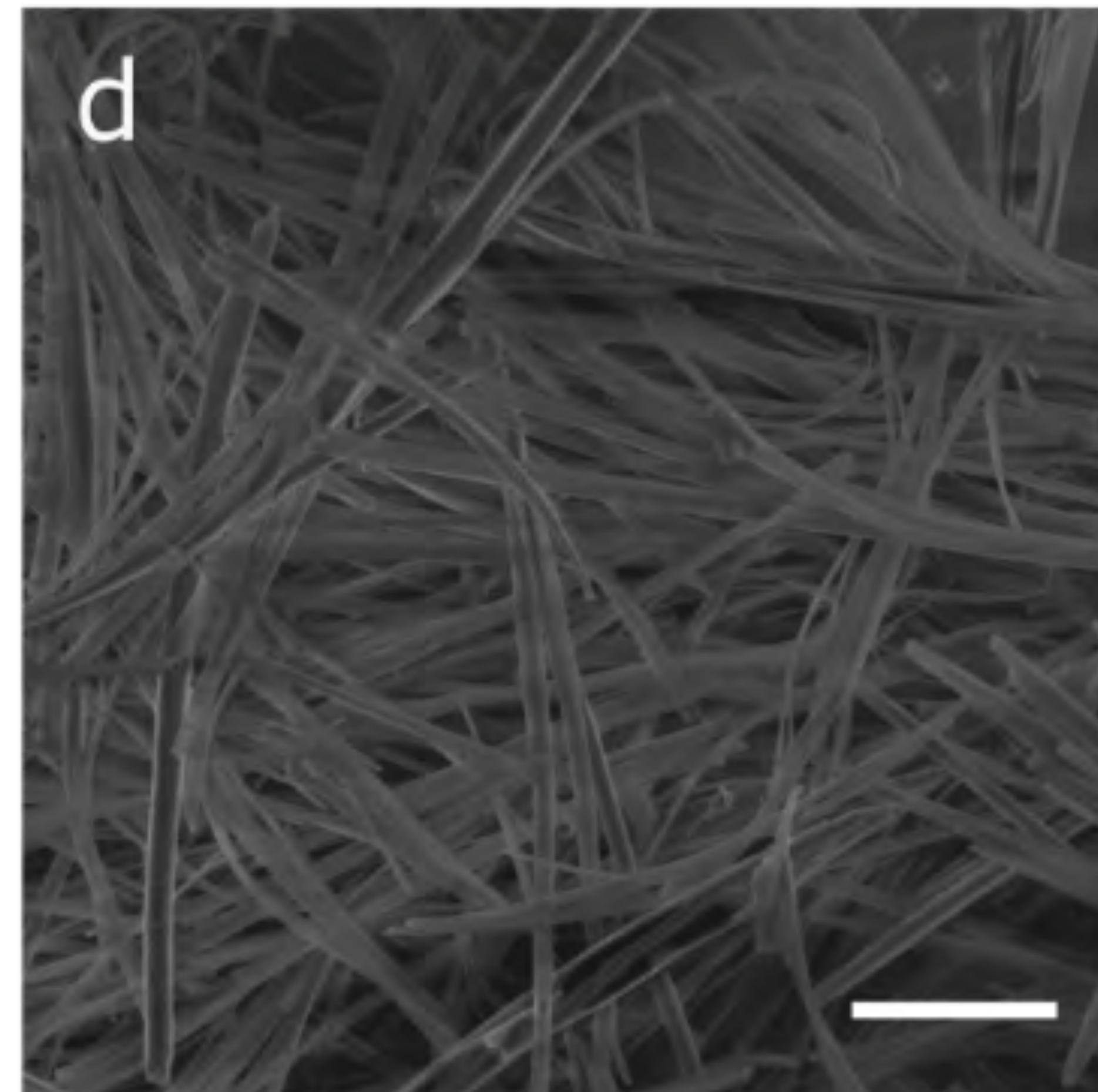
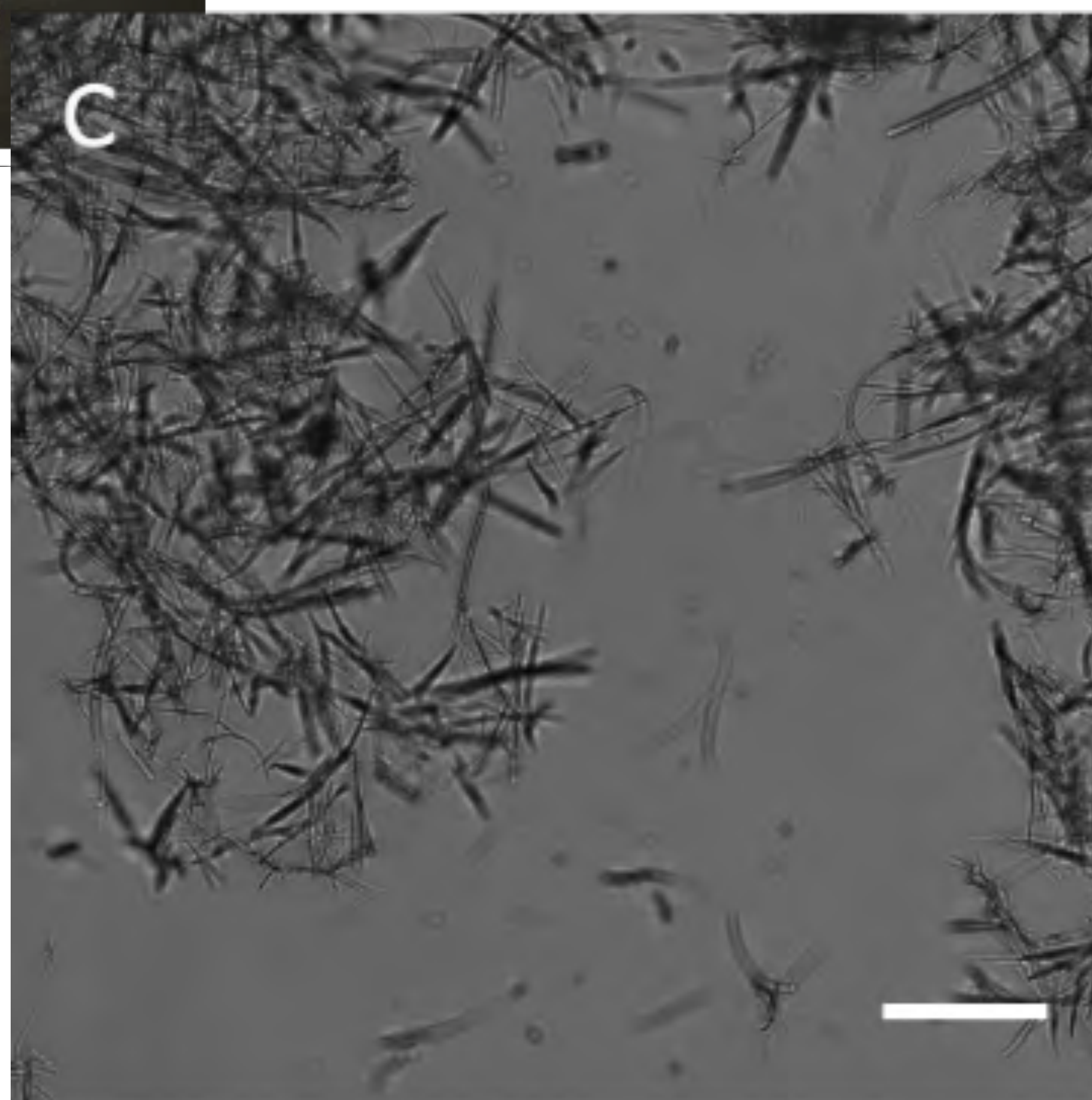
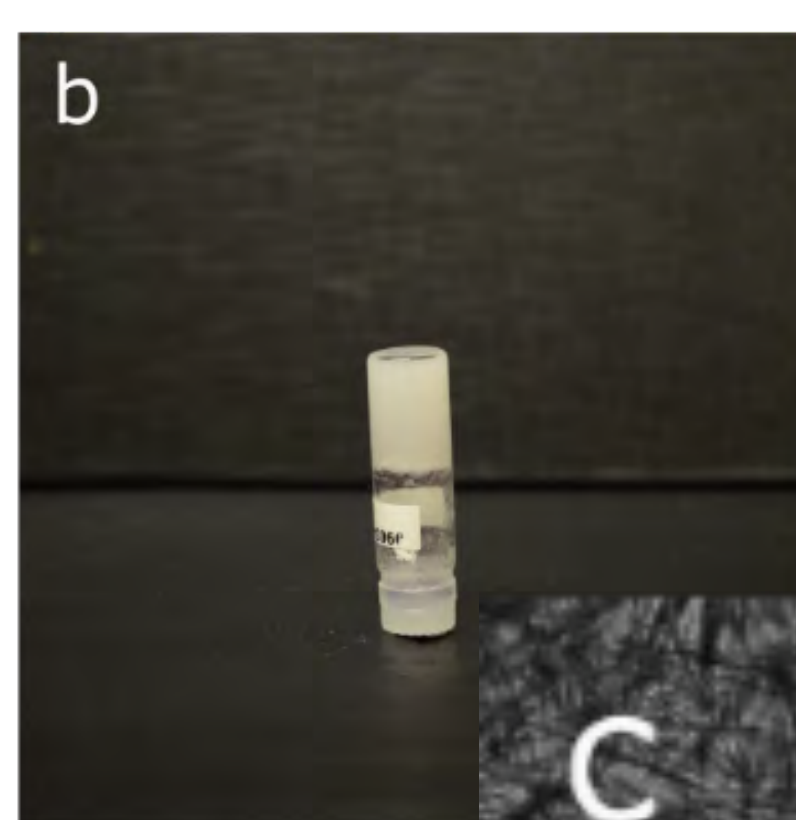
Textured microcapsules through crystallization. Wilson-Whitford, S., R.; Jaggars, R., W.; Longbottom, B., W.; Donald, M., K.; Clarkson, G., J.; and Bon, S., A., F. *ACS Applied Materials & Interfaces*, 13(4): 5887-5894. **2021**.



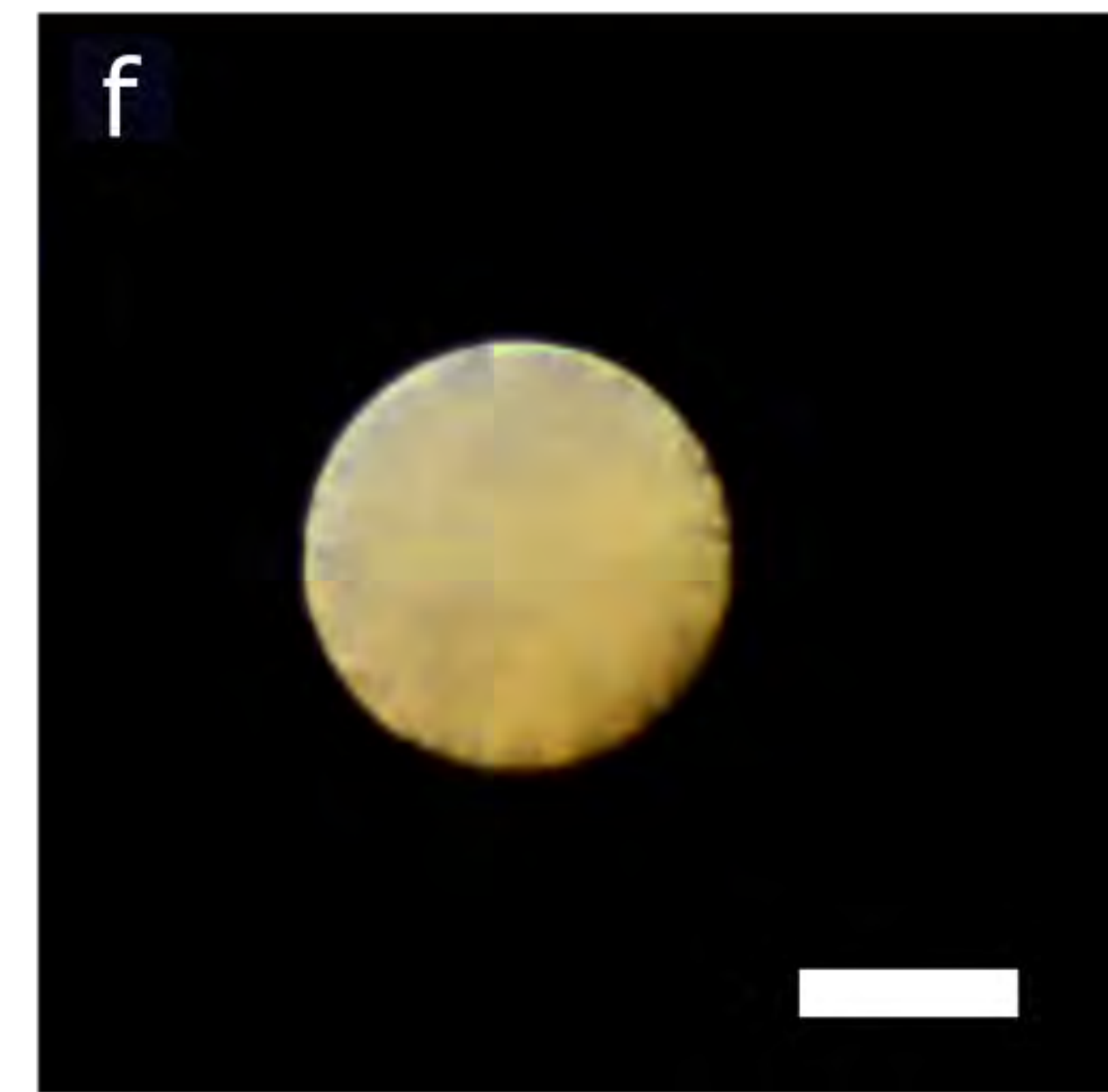
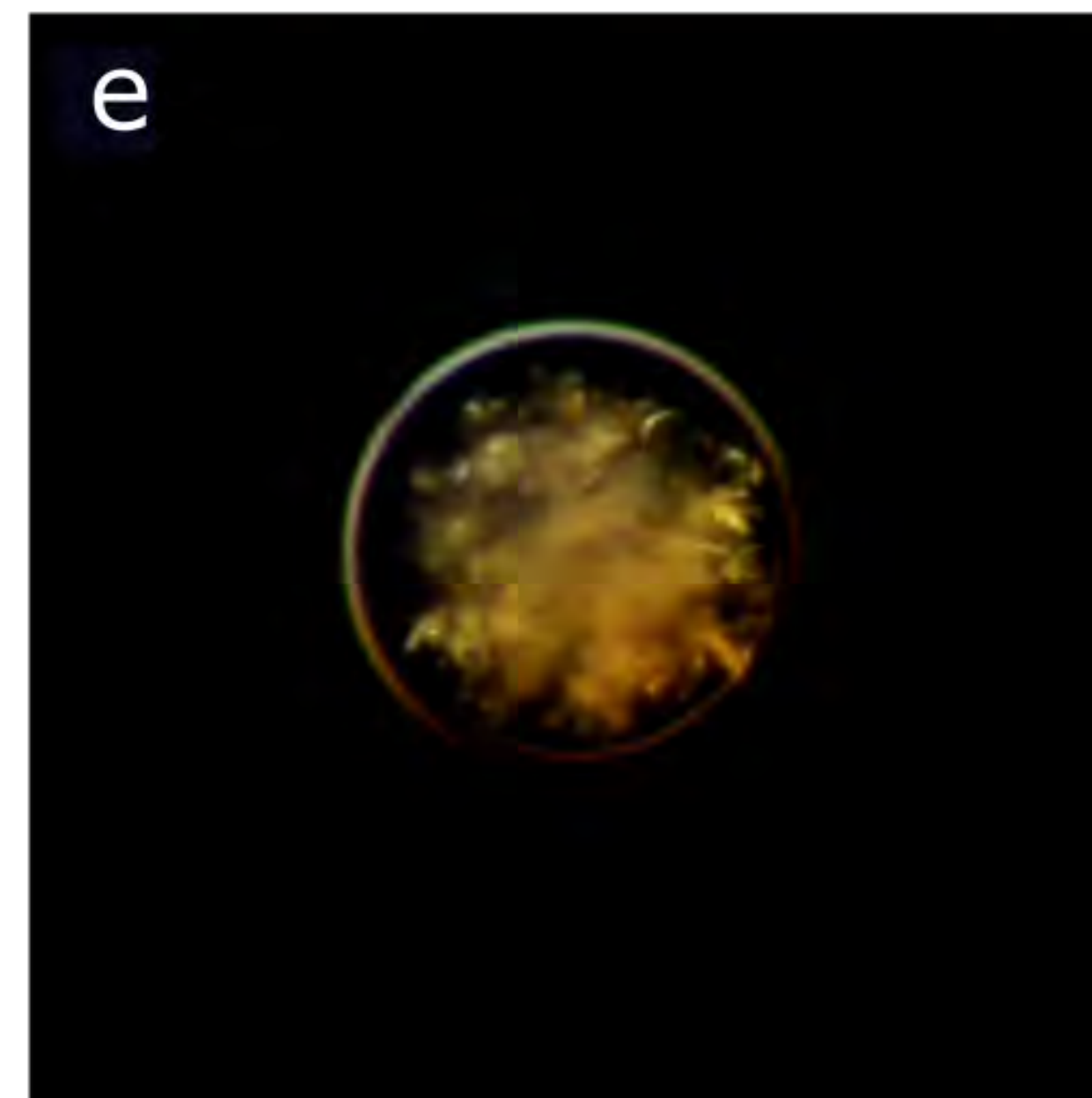
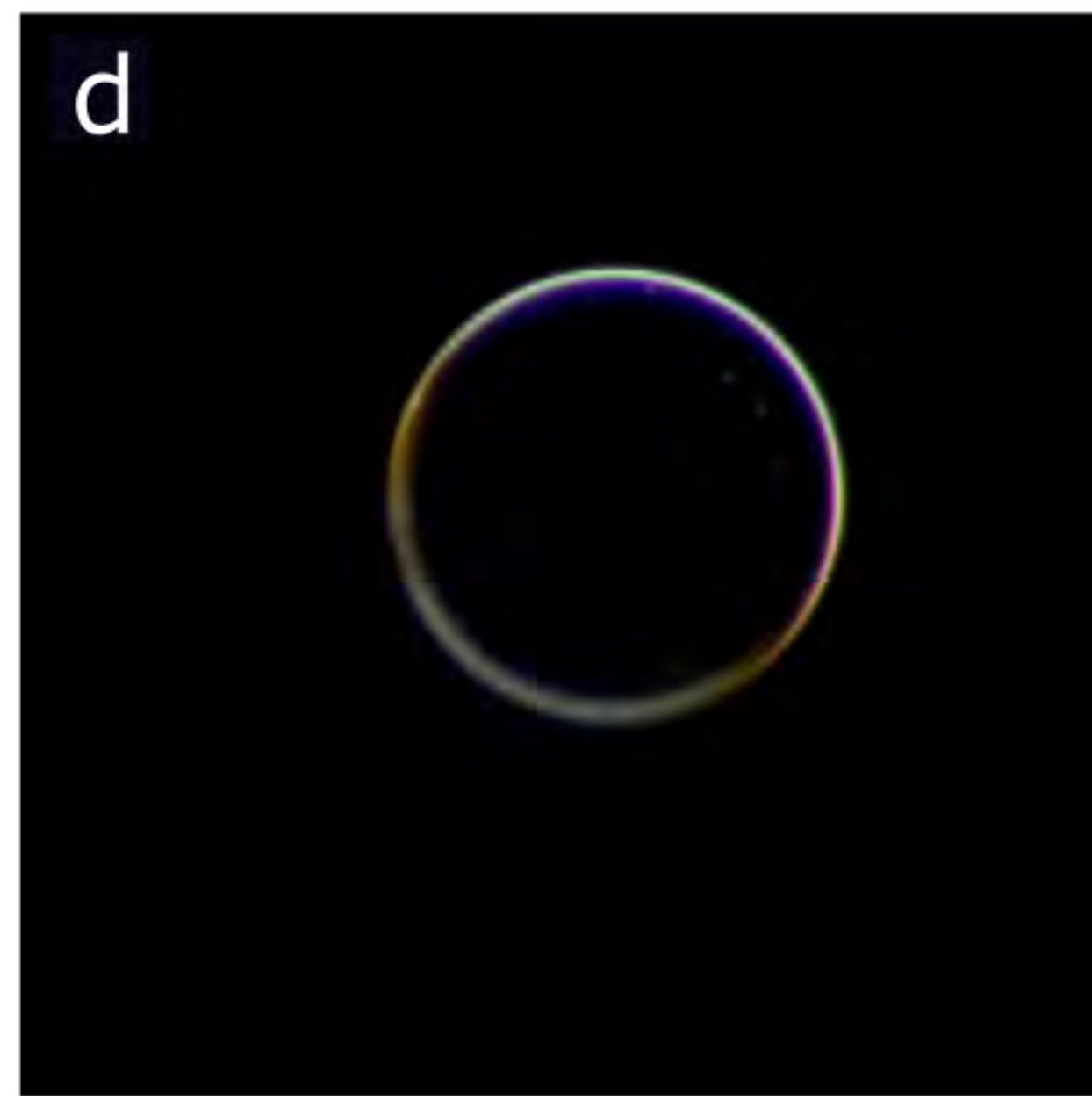
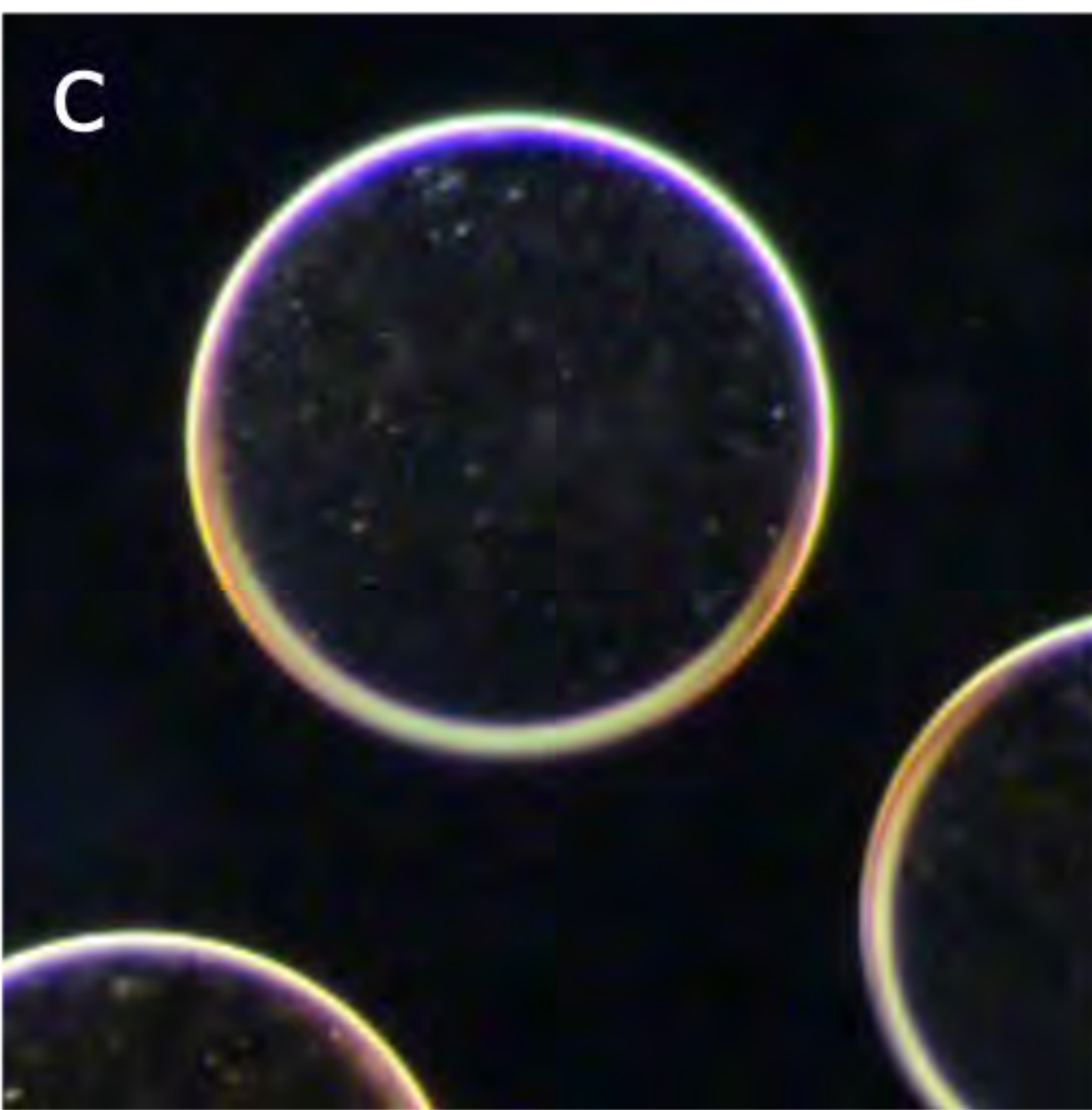
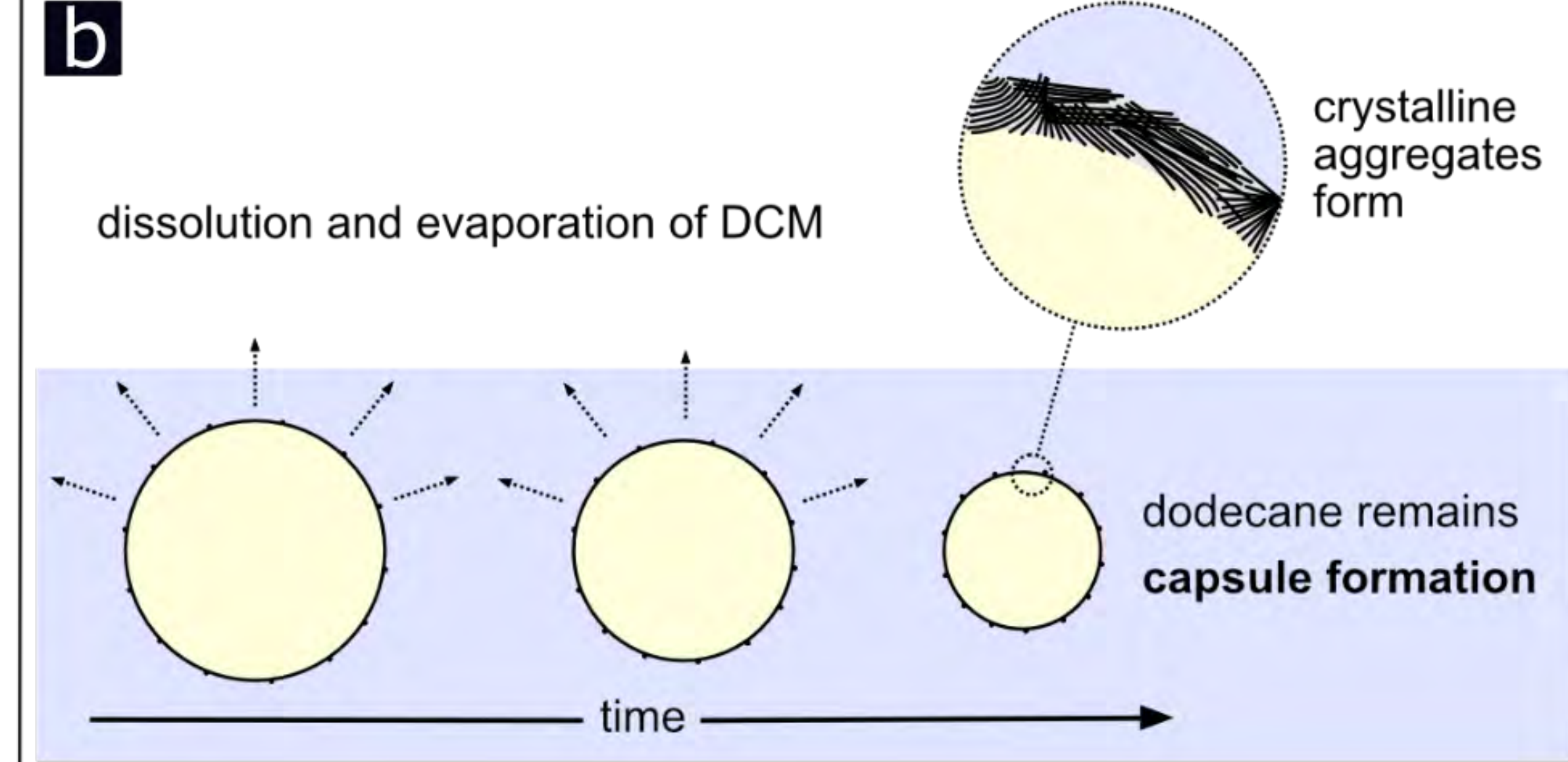
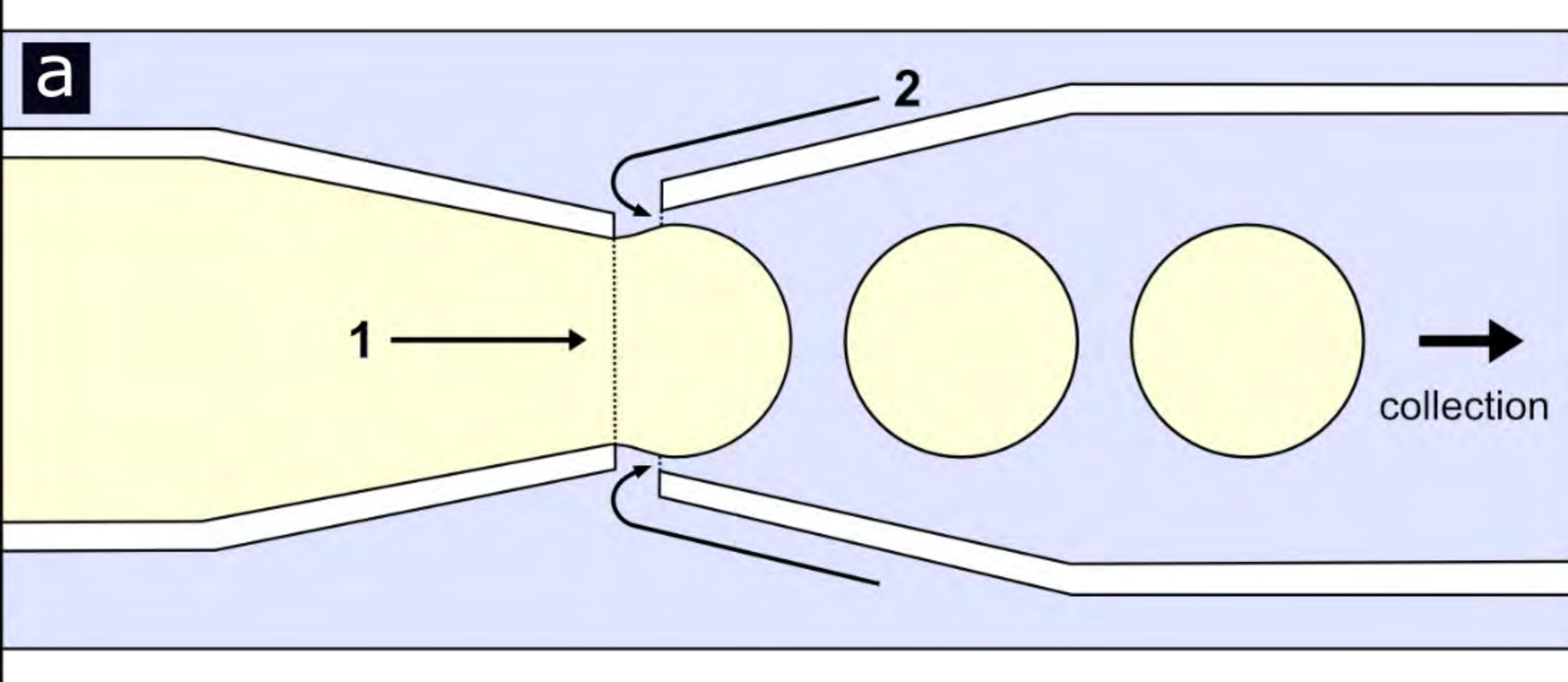
(a) Molecular structure of decane-1,10-bis(cyclohexyl carbamate) (DBCC), (b) Crystallographic structure of DBCC, (c) Crystal structure of DBCC down a-axis of the lattice, (d) down b-axis, (e) down c-axis.



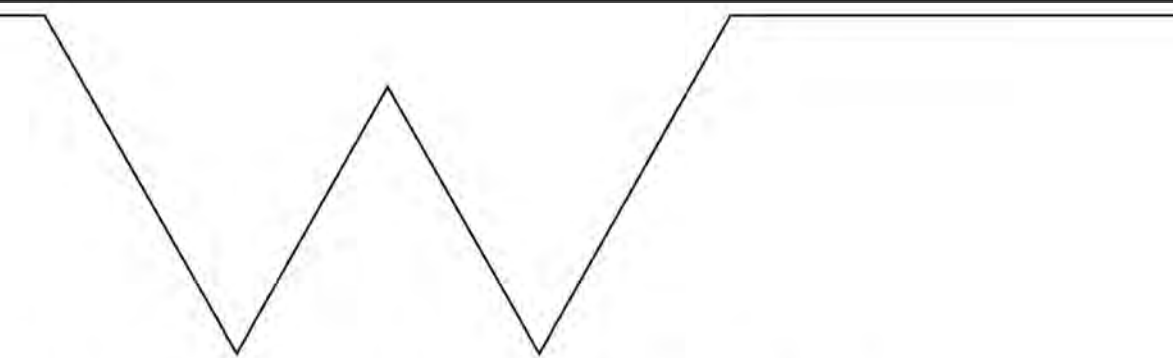


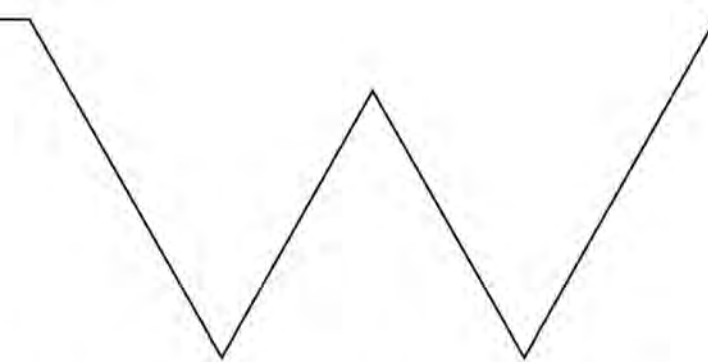
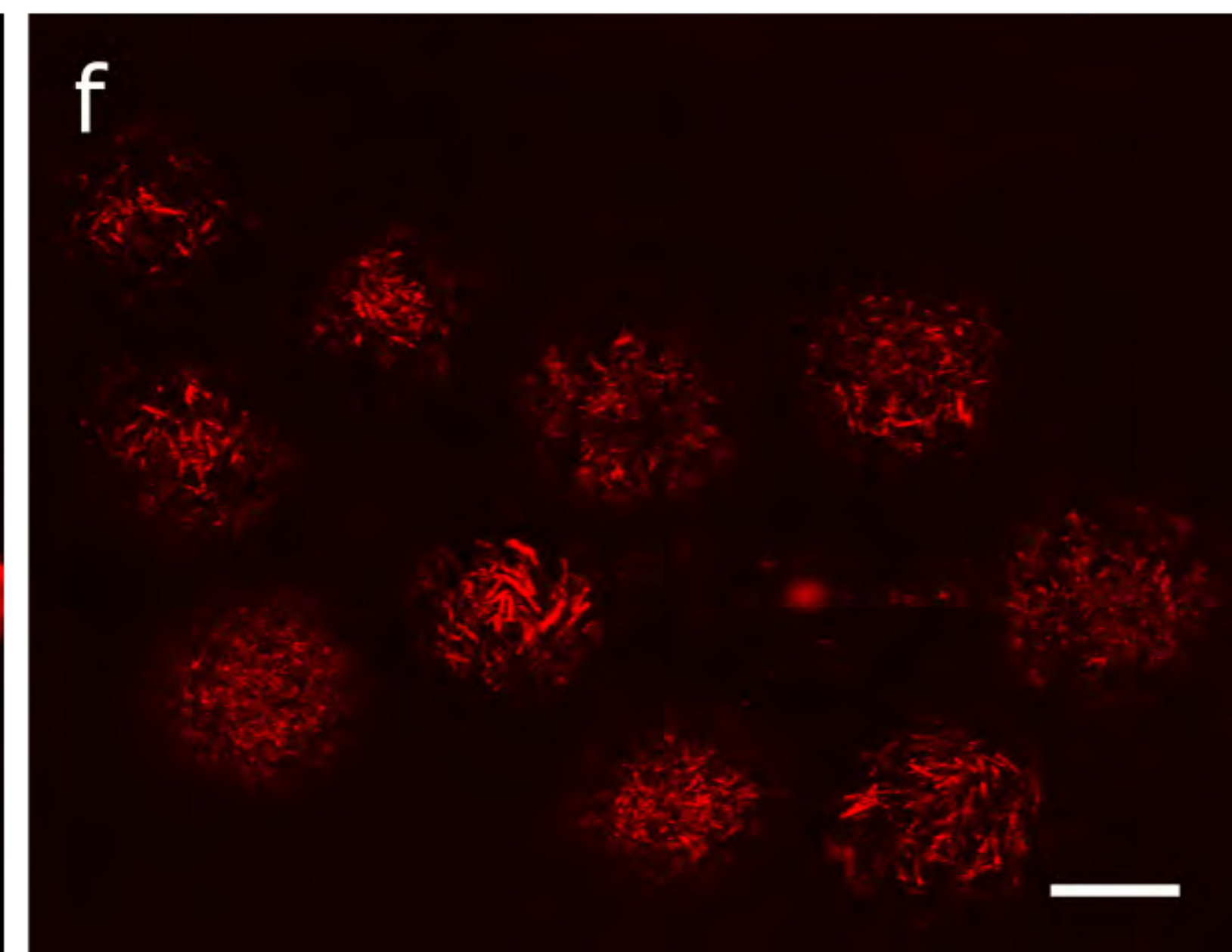
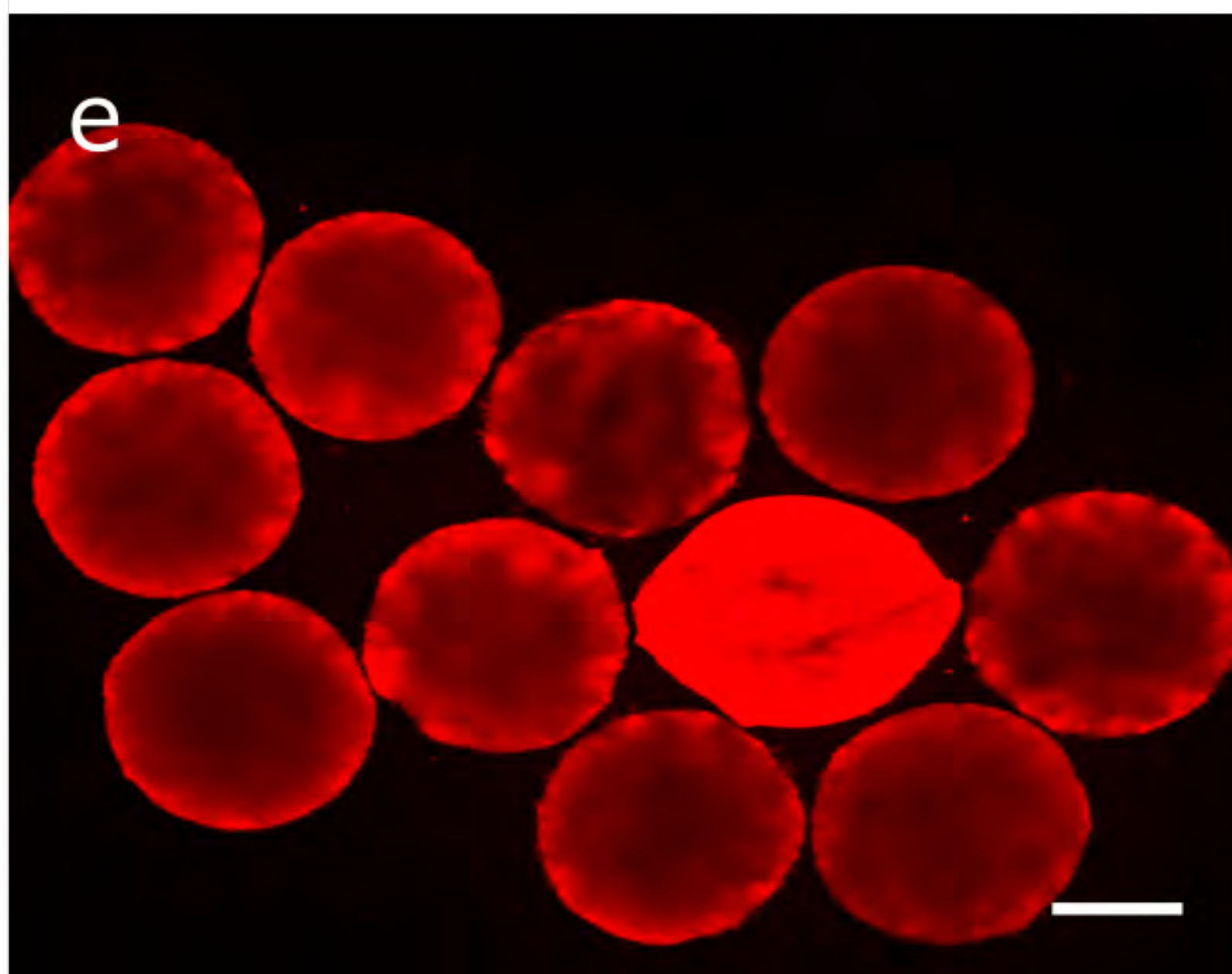
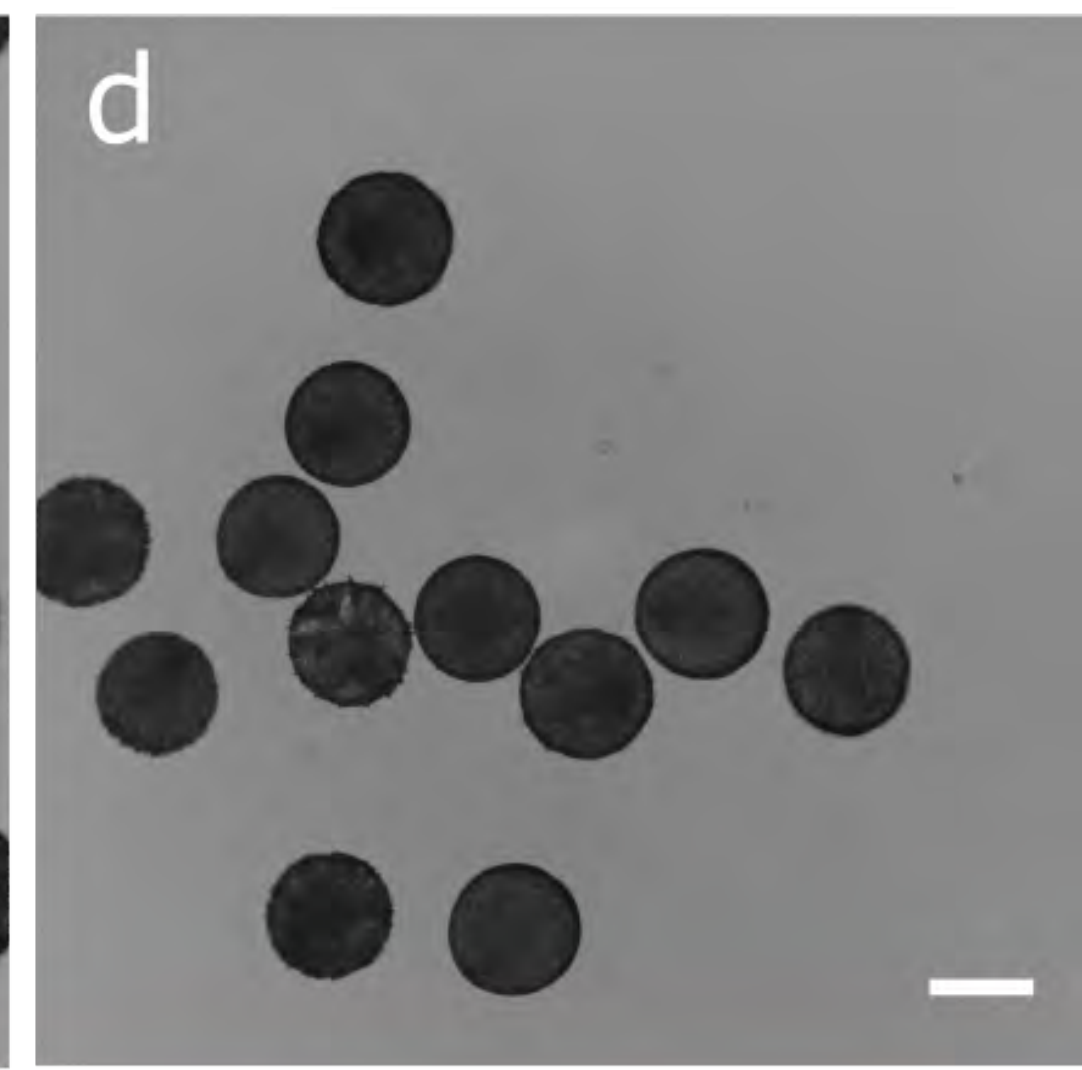
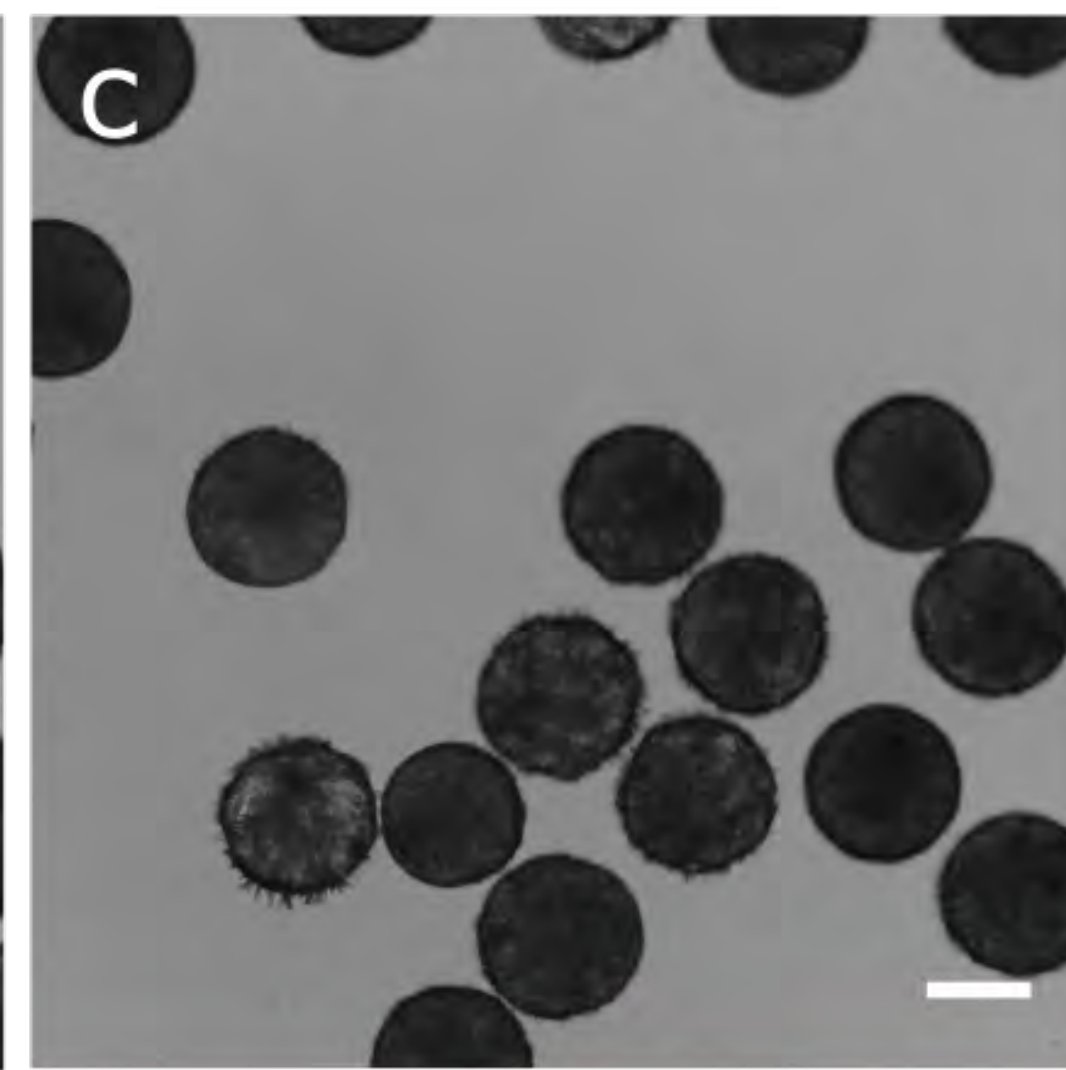
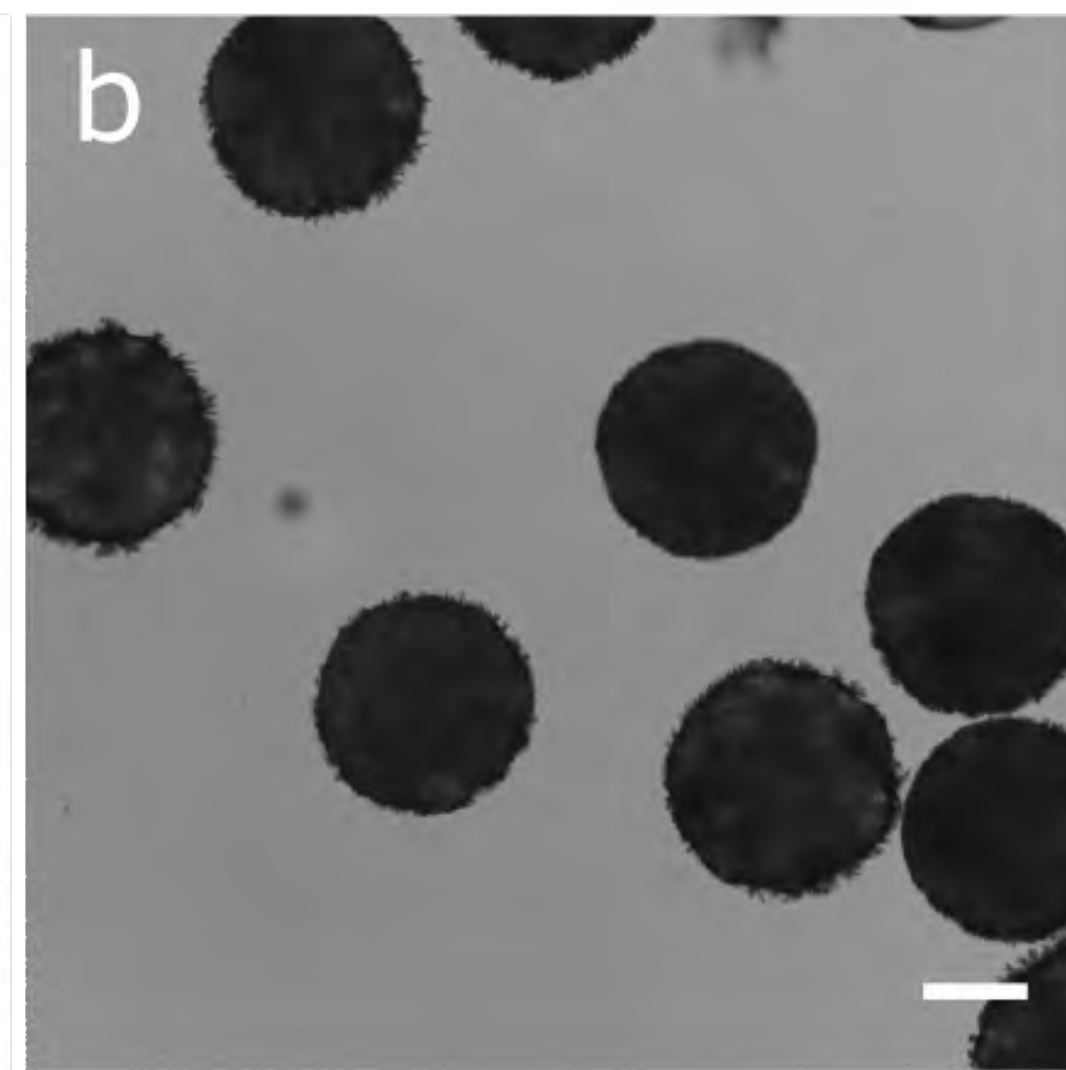
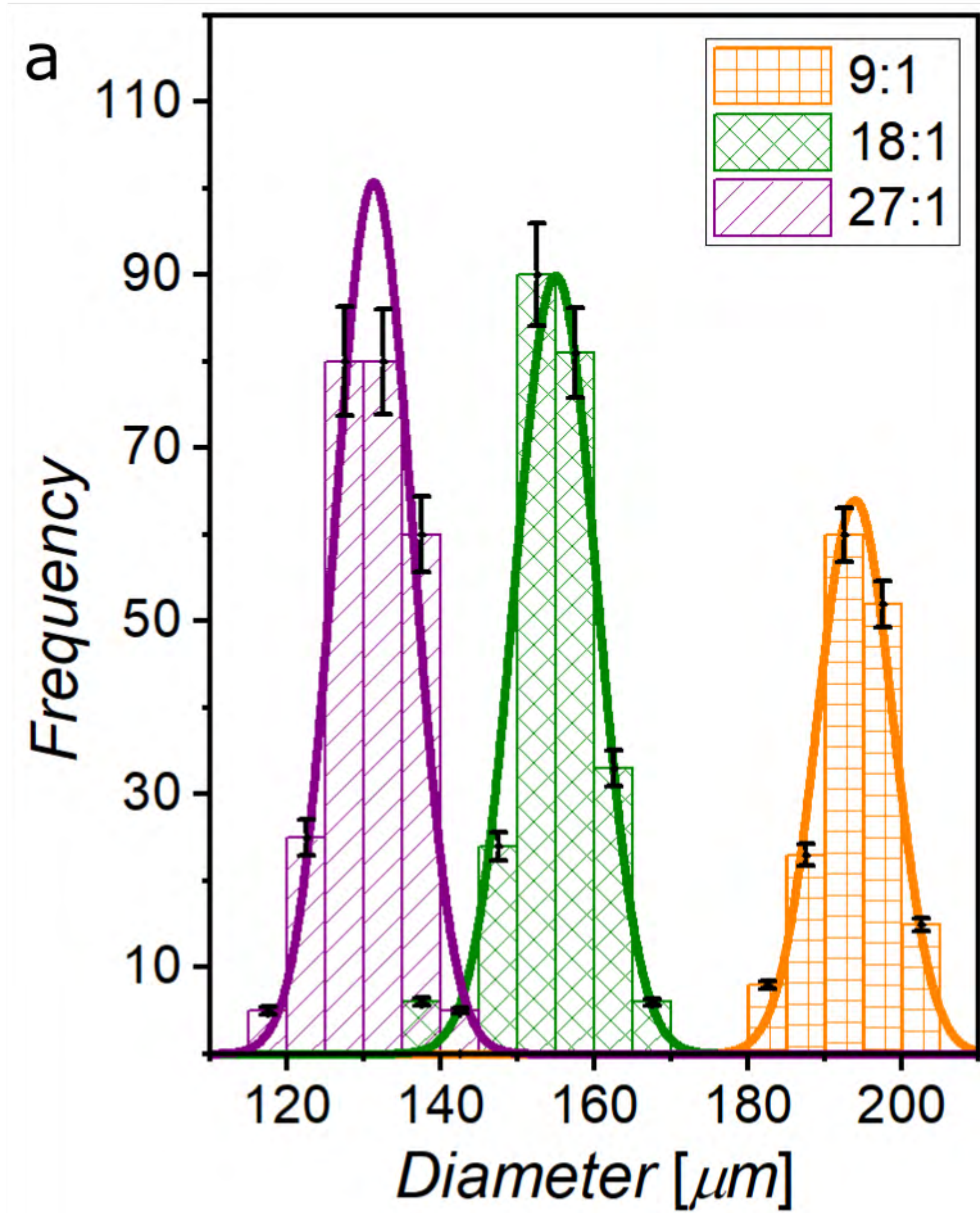


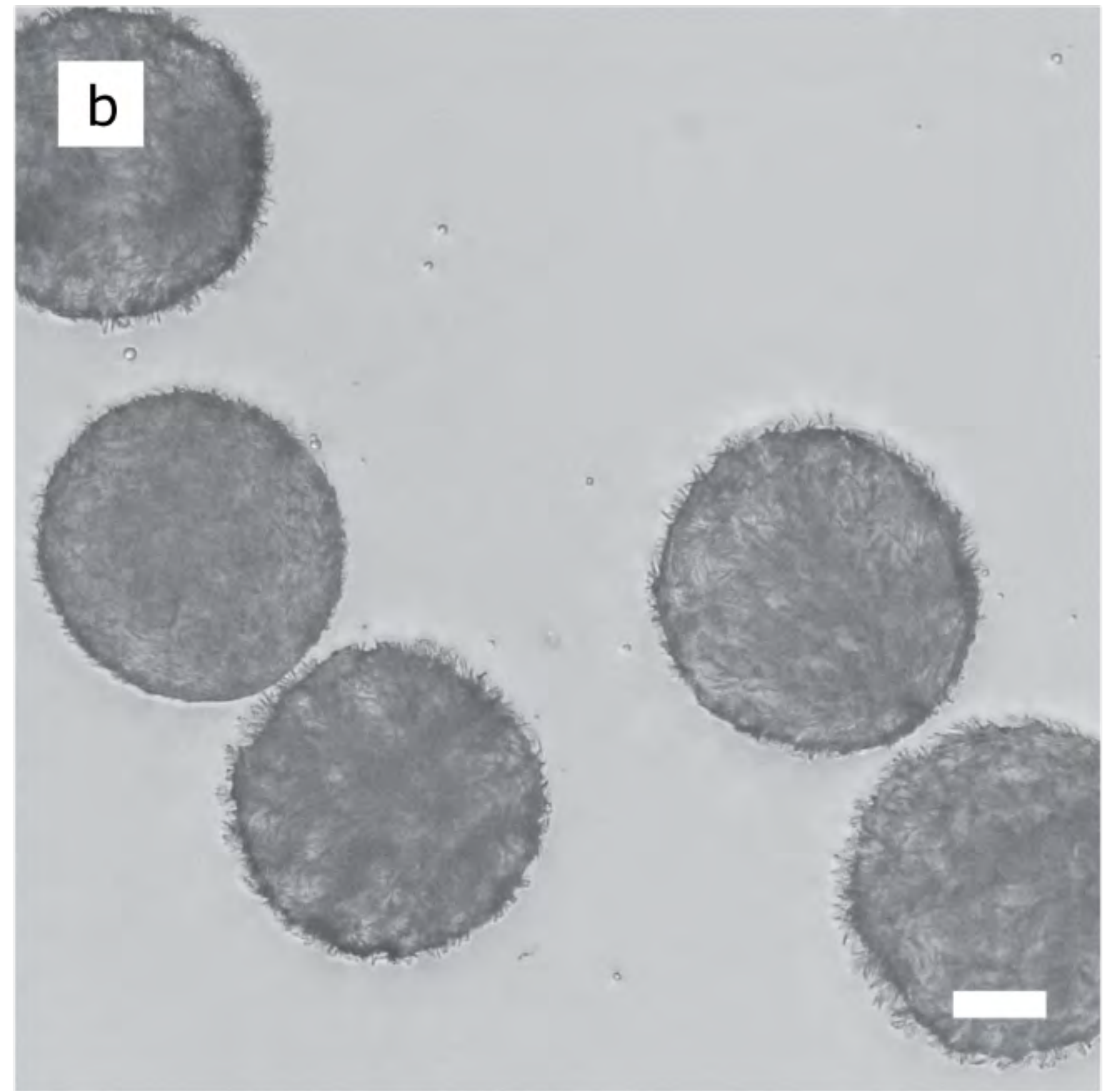
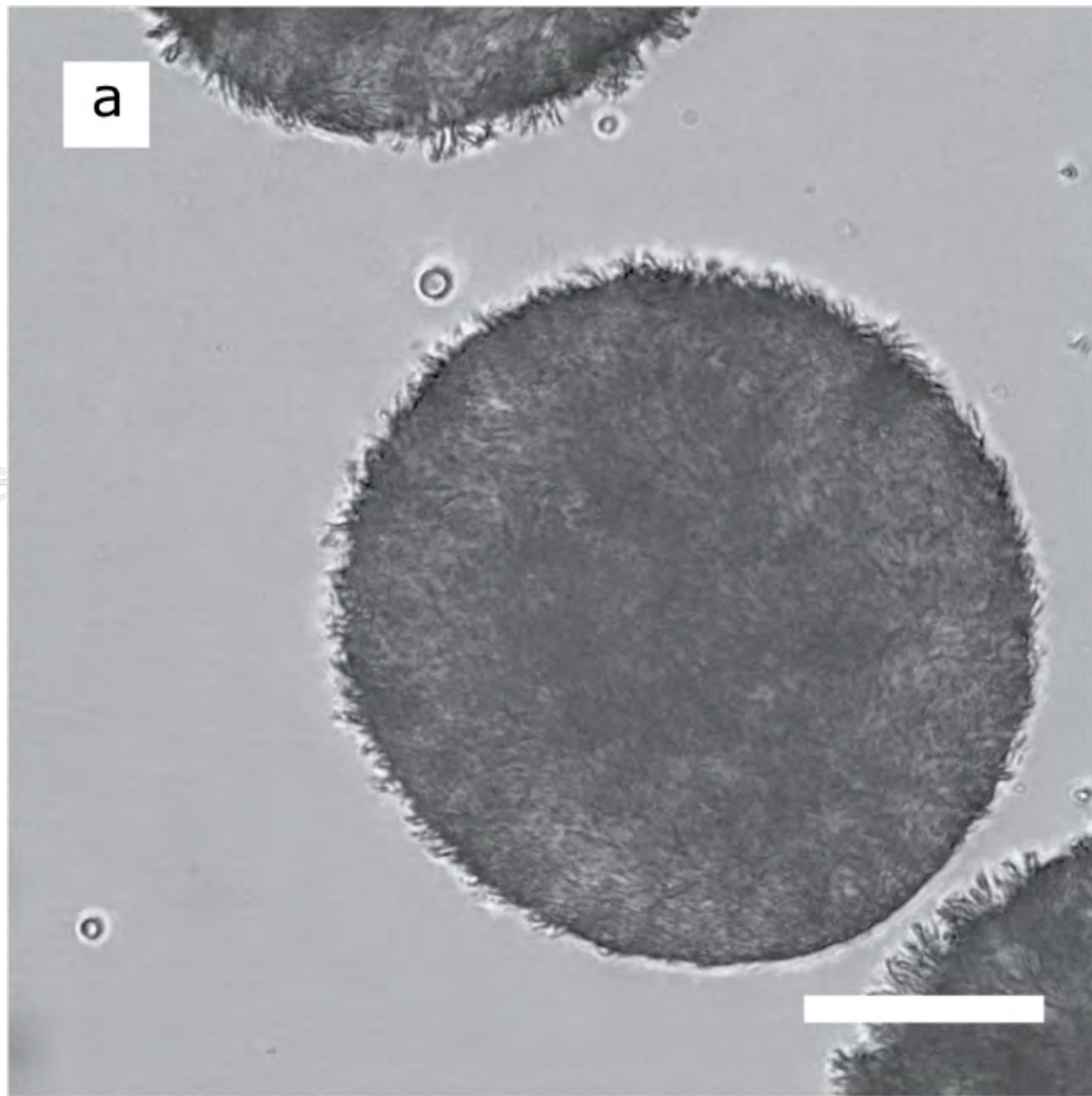
Inversion tests of organogels (a) 1 wt.% DBCC in dodecane (b) inversion of DBCC in dodecane (c) 20 x light microscopy of 1 wt. % DBCC in dodecane (100  $\mu\text{m}$ ) (d) SEM 1 wt. % DBCC in dodecane (10  $\mu\text{m}$ ).



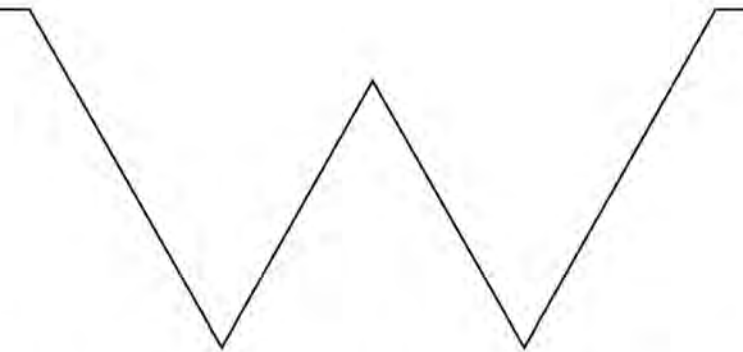
Total DCM evaporation causes DBCC crystallization, forming an armor around the droplet (c) Droplet immediately following its formation (d) 7 min 27 s, total DCM evaporation (e) 7 min 31 s, DBCC supersaturation (f) 7 min 34 s, completed capsule. Scale bar = 100  $\mu\text{m}$

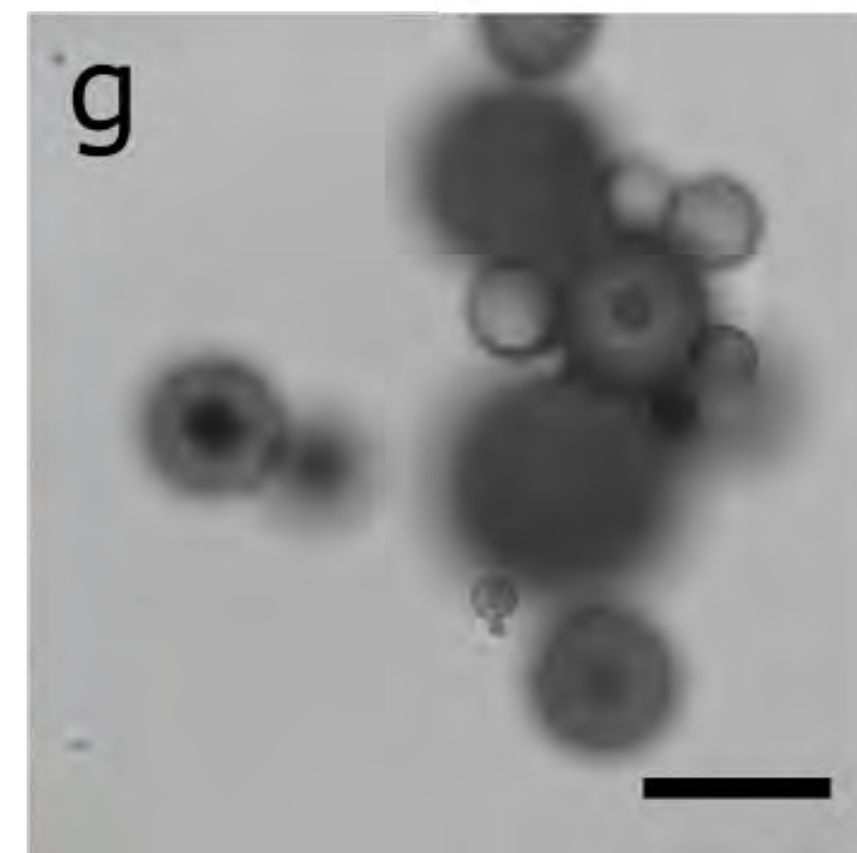
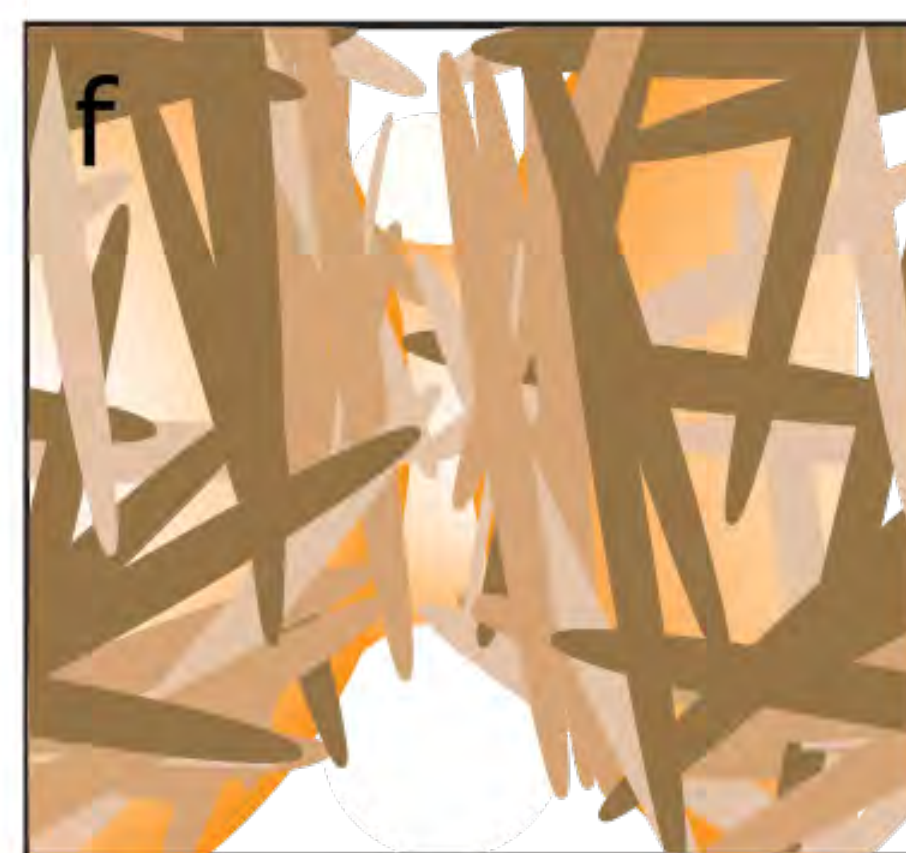
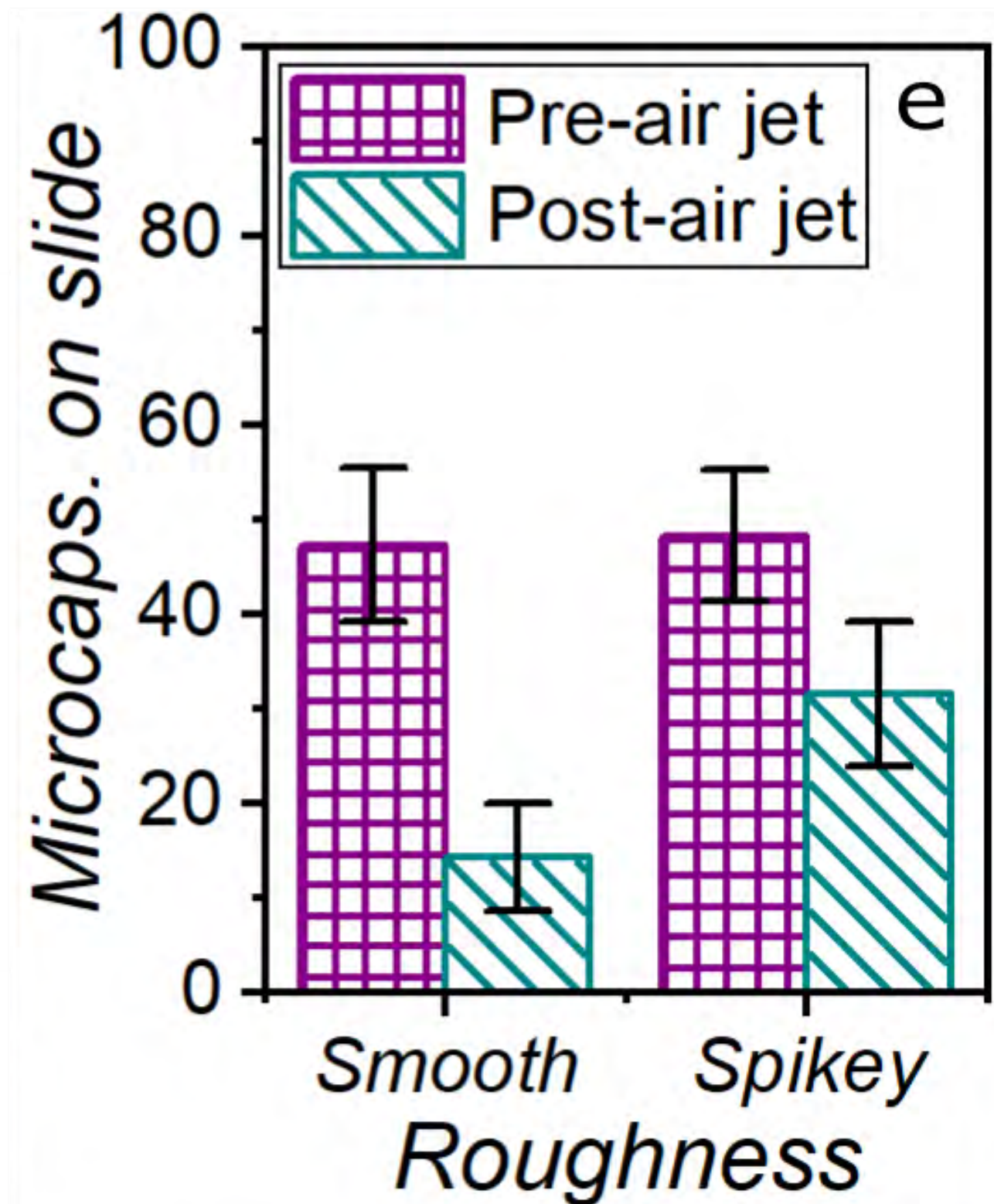
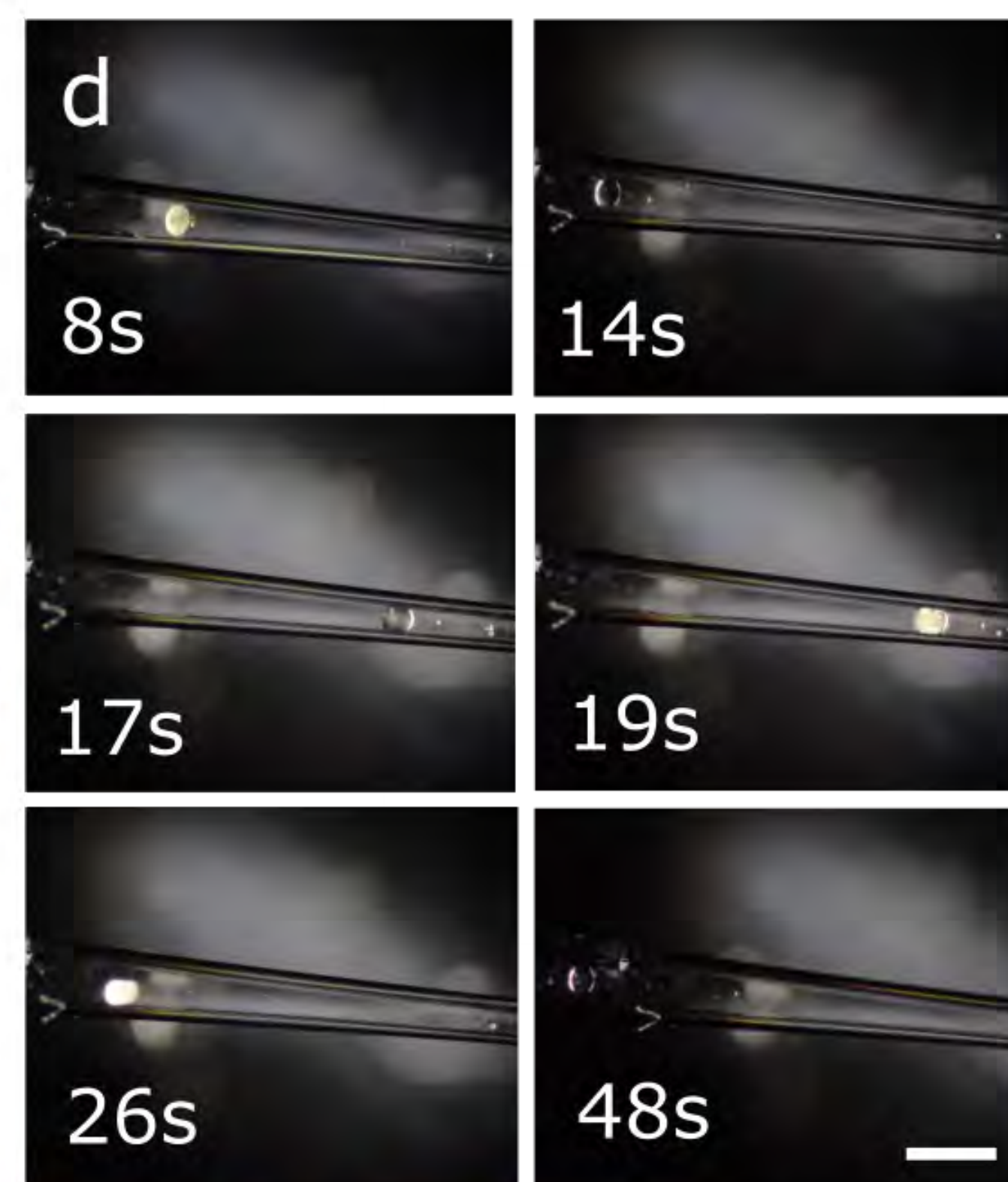
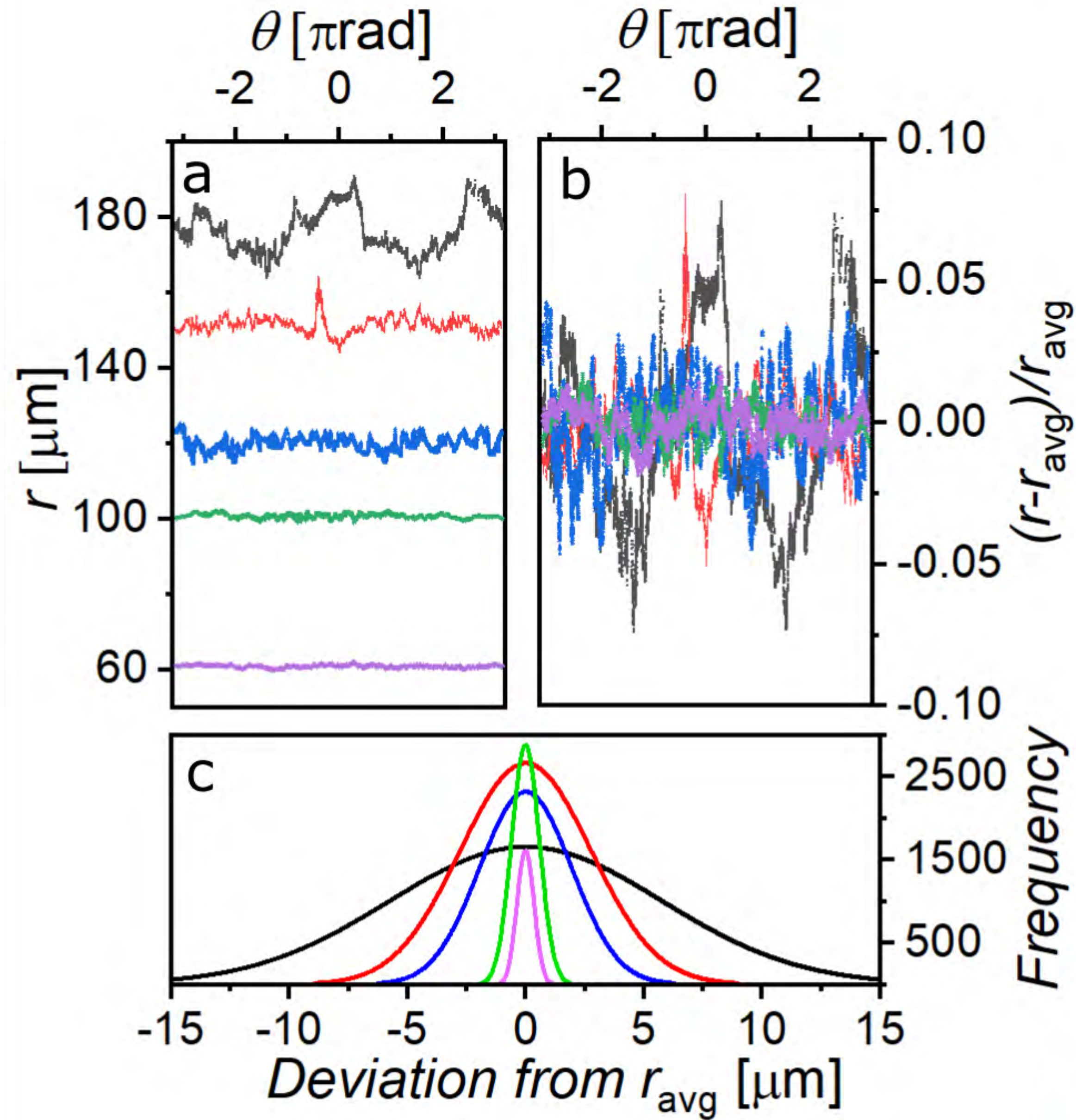


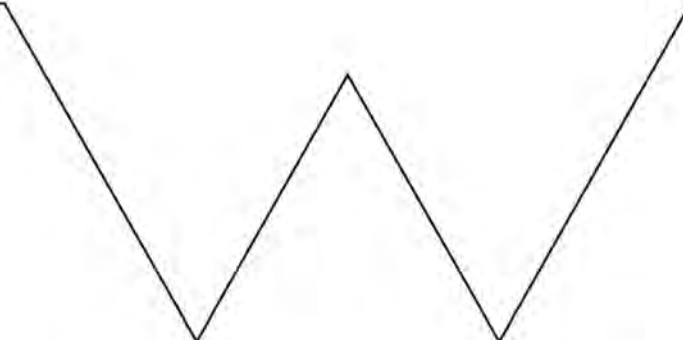


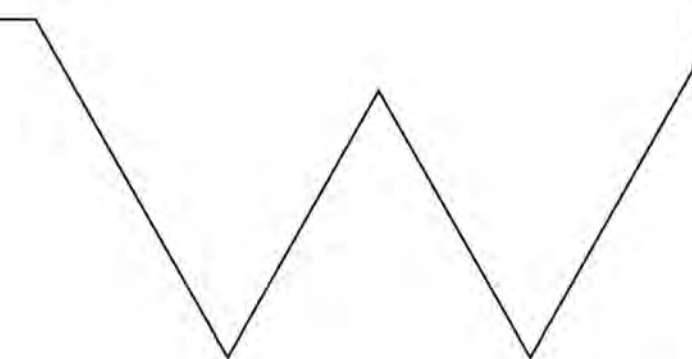
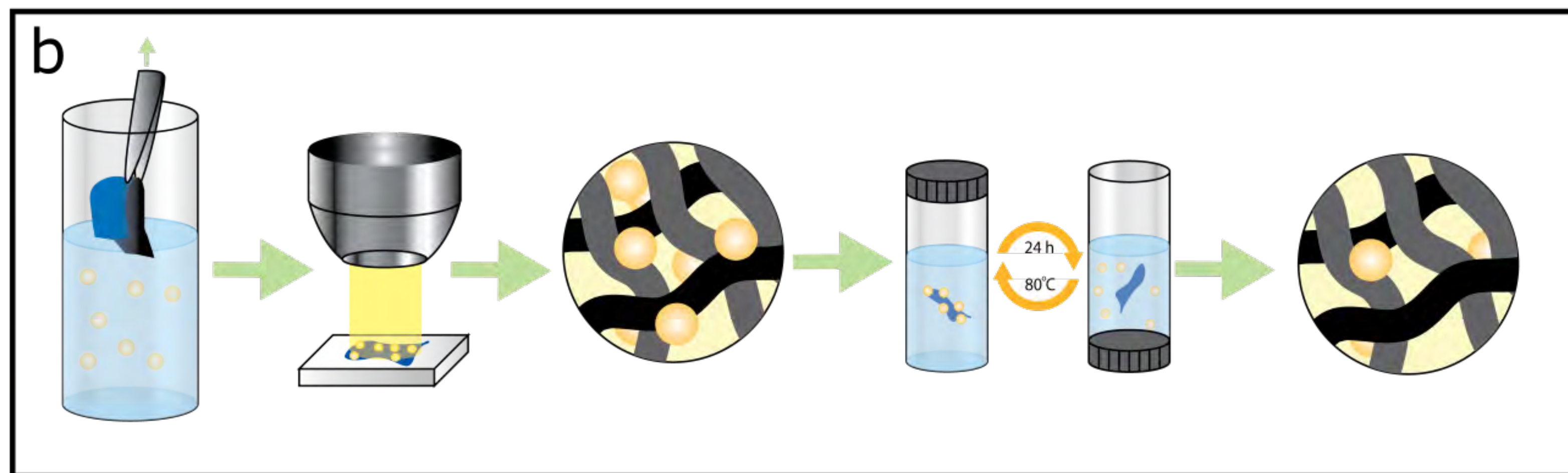
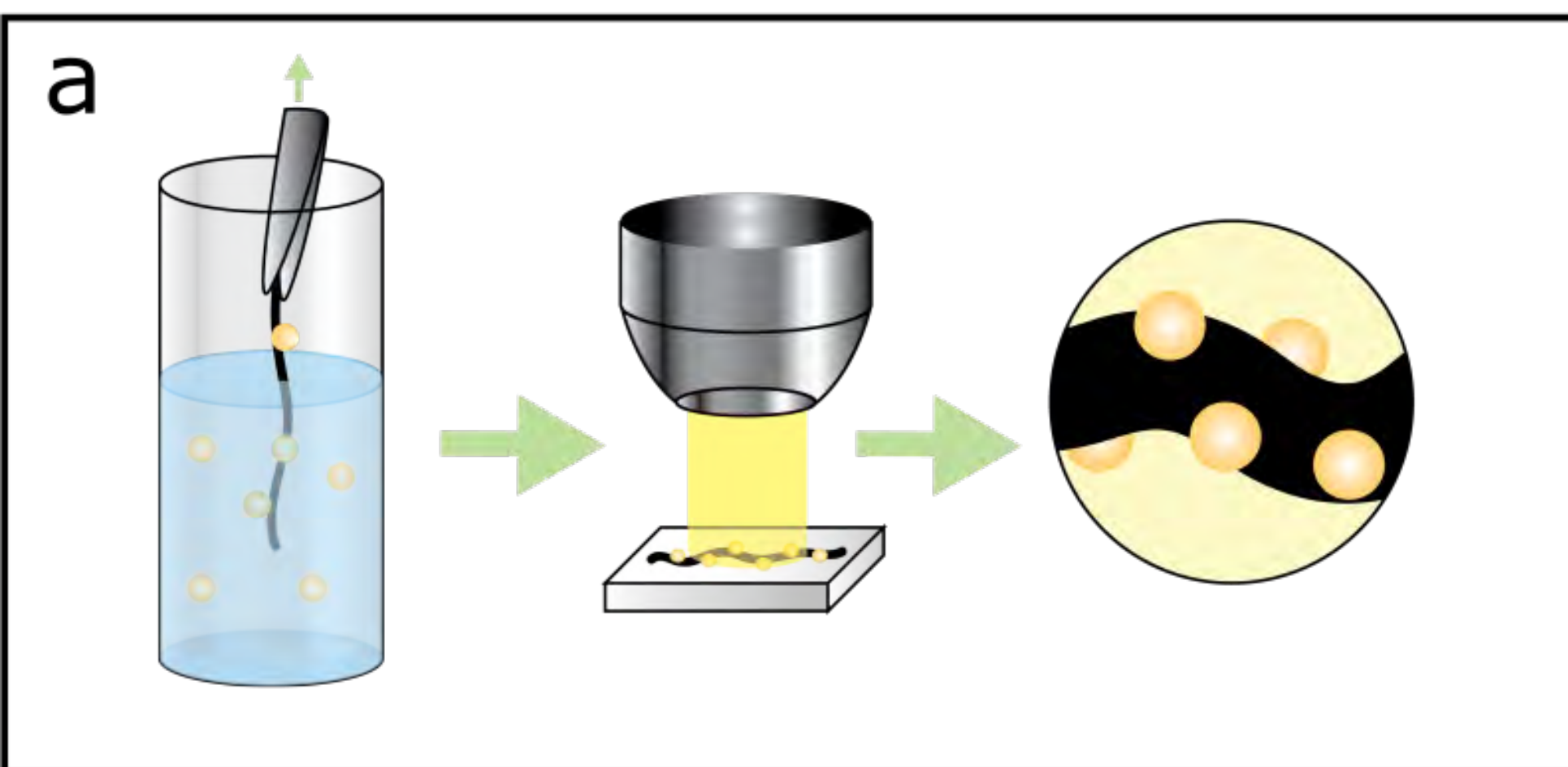


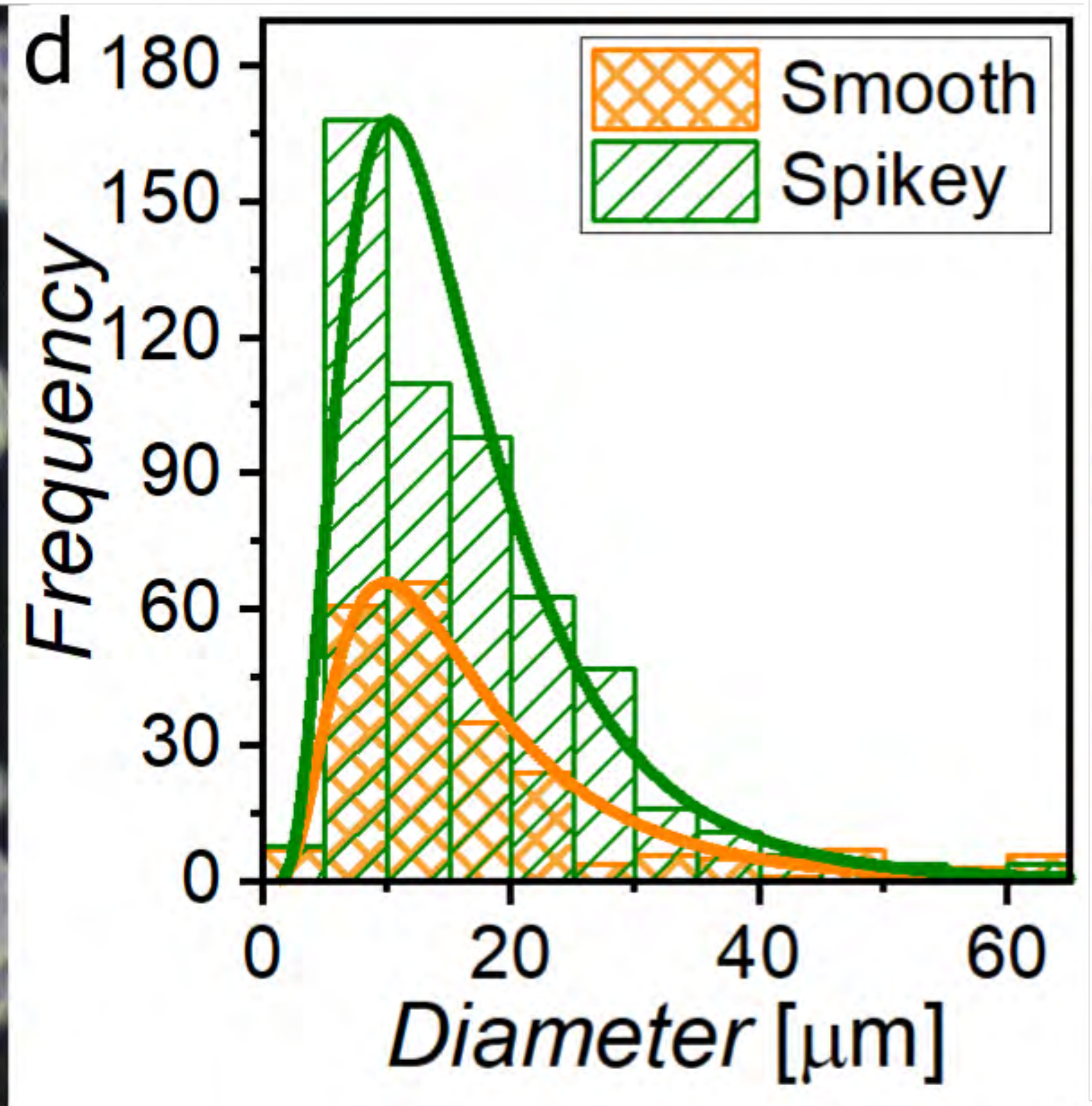
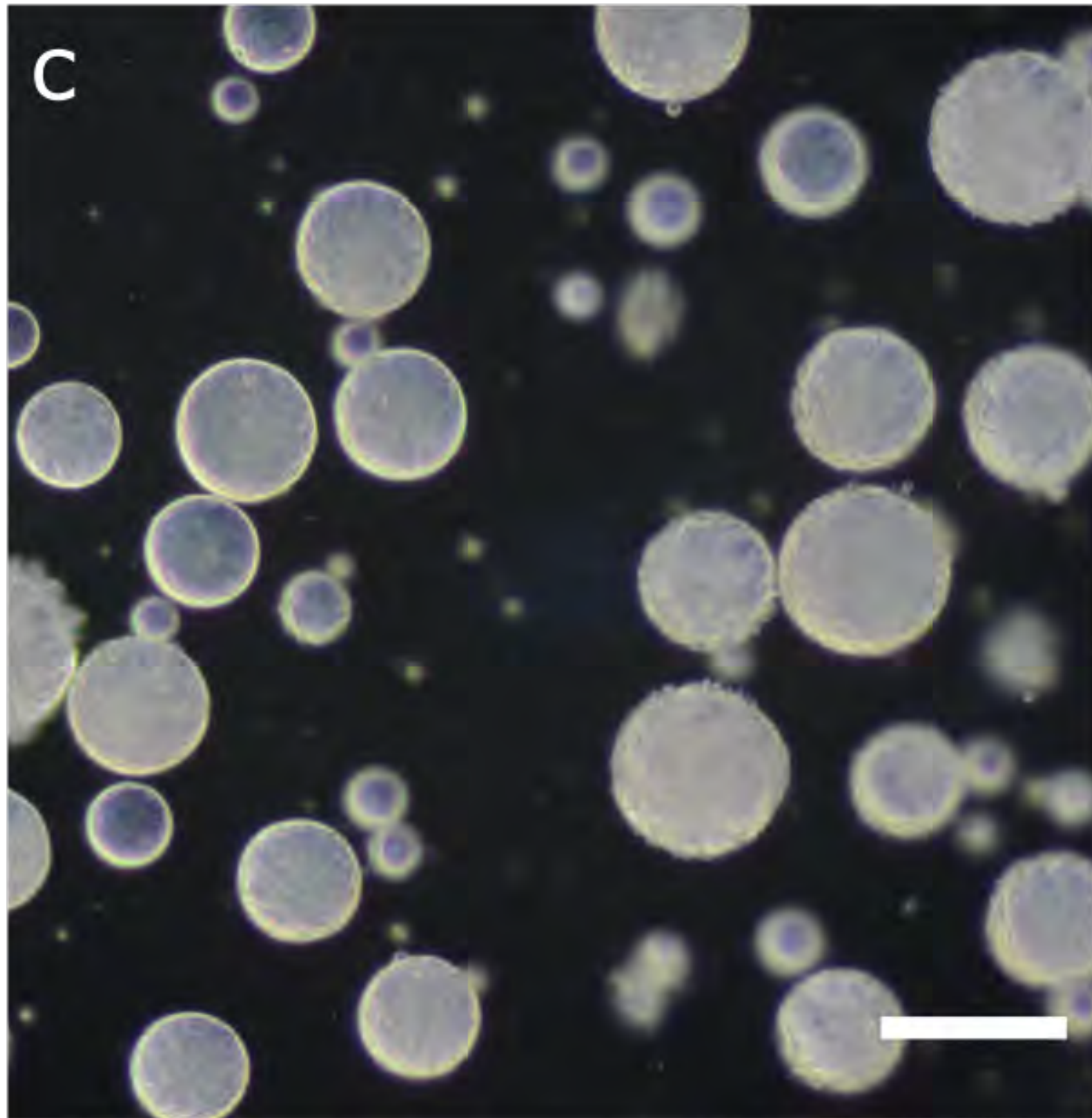
Light microscopy of textured surface of microcapsules generated by microfluidics  
(a) Scale bar = 100  $\mu\text{m}$  (b) Scale bar = 50  $\mu\text{m}$ .





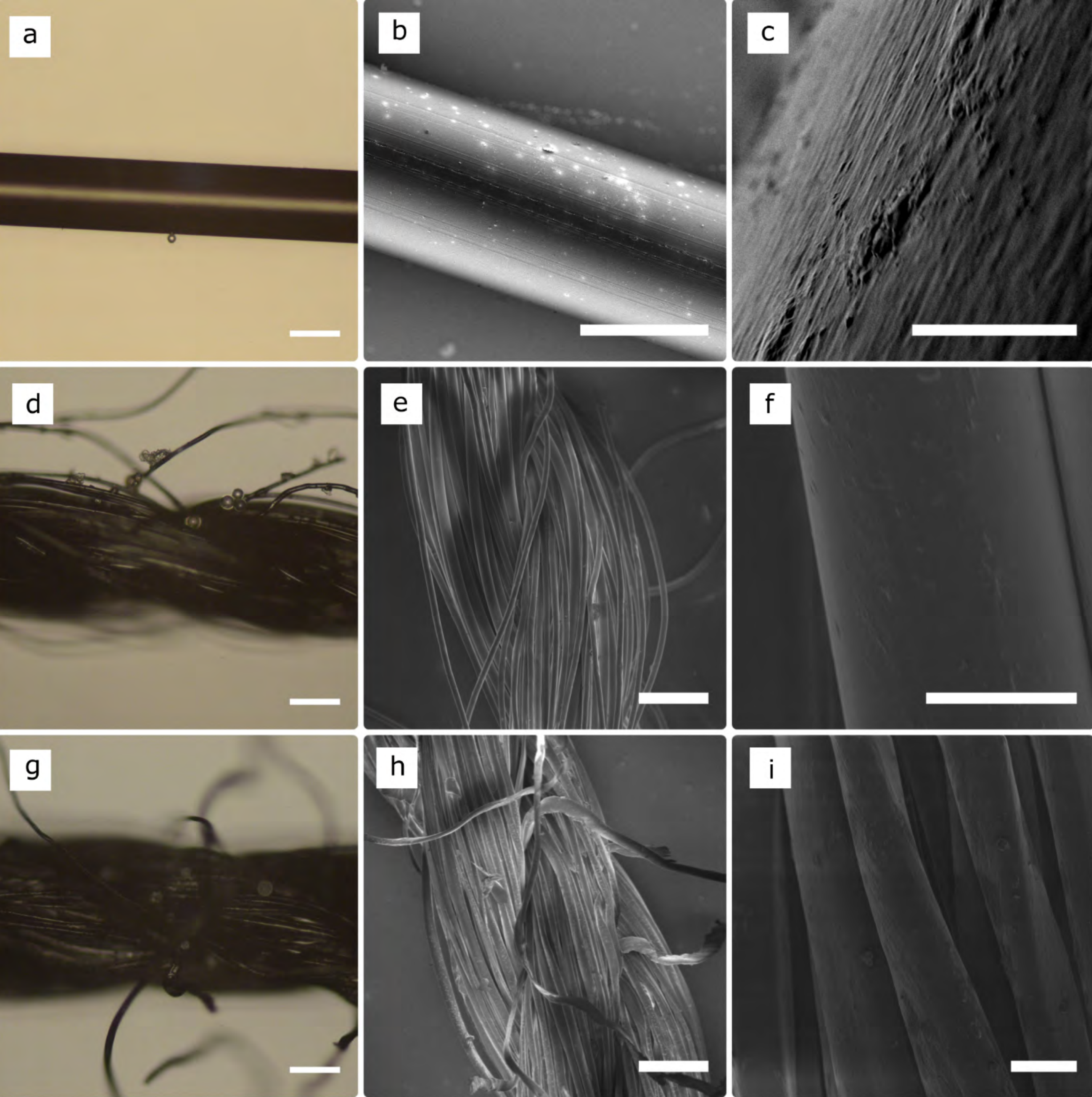




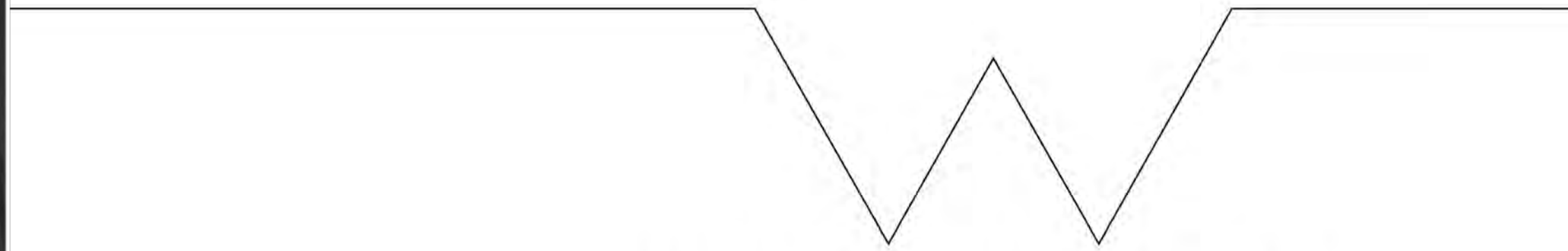


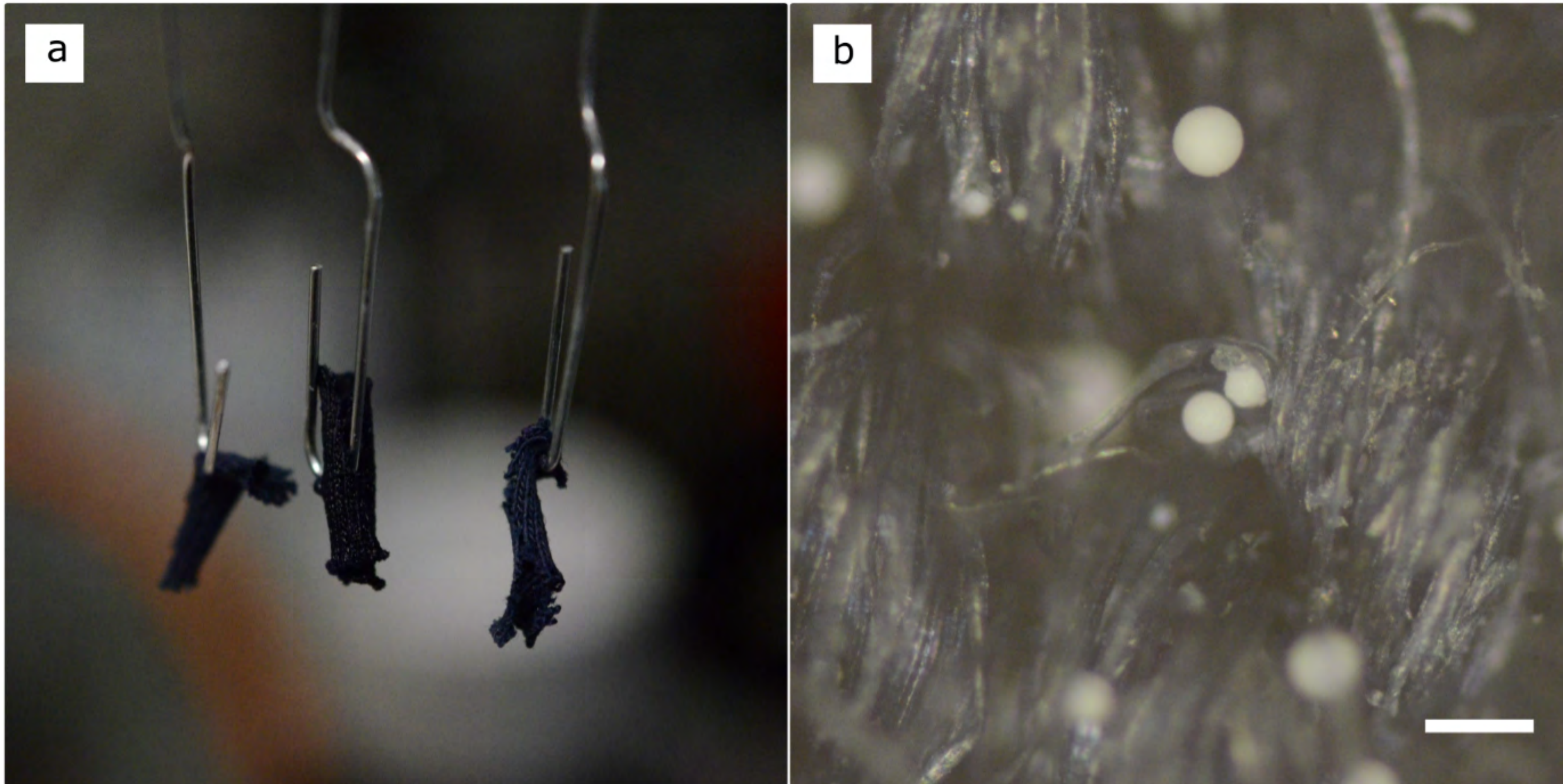
c) Dark-field light microscopy of batch synthesized DBCC spikey capsules . Scale bar = 30  $\mu\text{m}$   
d) Histograms of batch synthesis capsule sizes for smooth (cross diag.: coral) and spikey (diag. up: green) microcapsules.



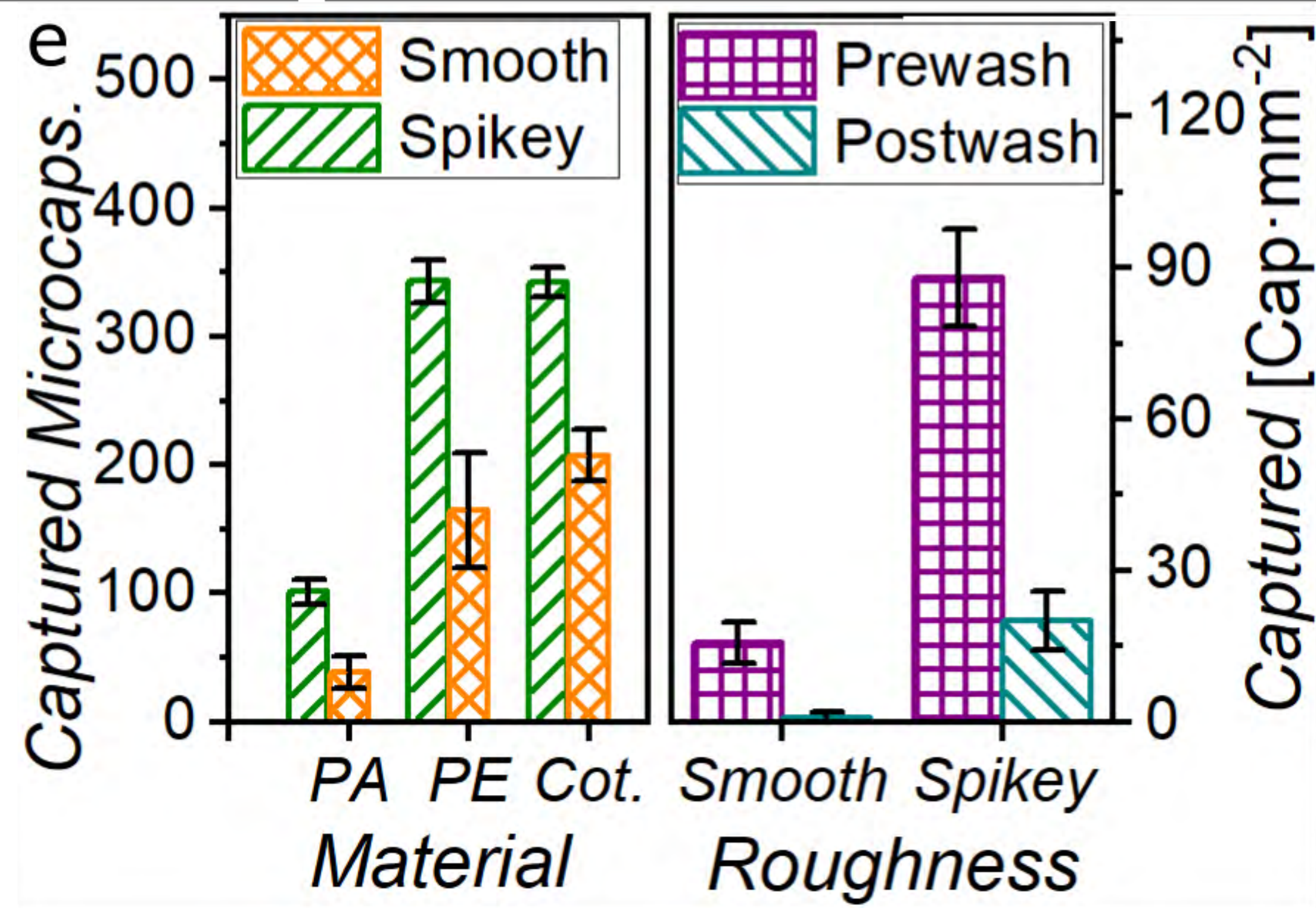
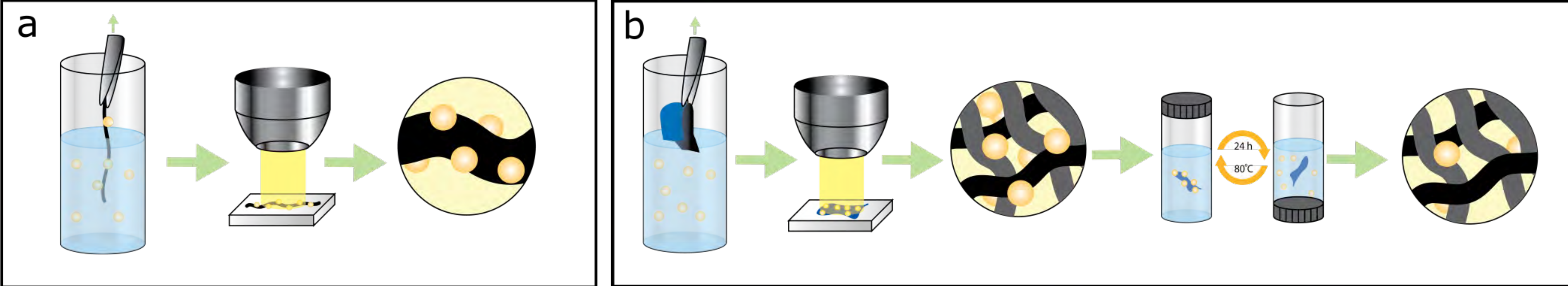


(a) Backscatter light microscopy of **polyamide fibre** with adhered capsule. Scale: 100  $\mu\text{m}$  (b-c) SEM microscopy of polyamide. Scale: 100  $\mu\text{m}$  and 5  $\mu\text{m}$  (d) Backscatter light microscopy of **polyester fibre** with adhered capsules. Scale: 100  $\mu\text{m}$  (e-f) SEM microscopy of polyester. Scale: 100  $\mu\text{m}$  and 10  $\mu\text{m}$  (g) Backscatter light microscopy of **cotton fibre** with adhered capsules. Scale: 100  $\mu\text{m}$  (h-i) SEM microscopy of cotton. Scale: 100  $\mu\text{m}$  and 10  $\mu\text{m}$ .

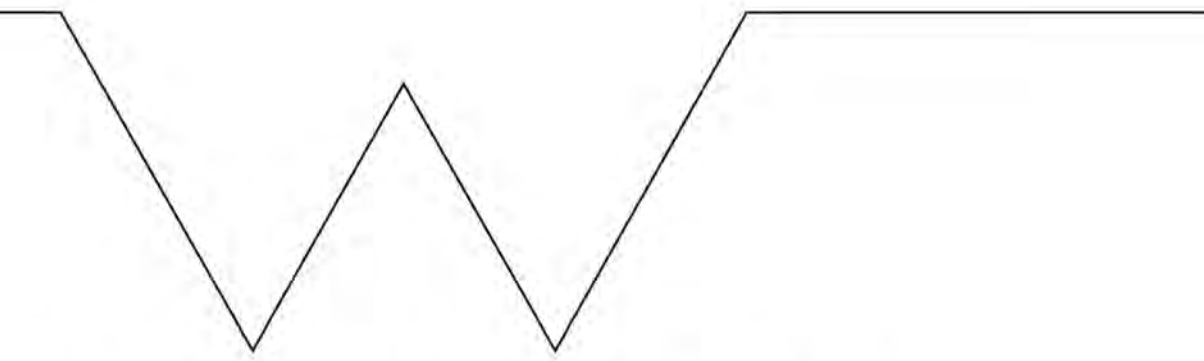




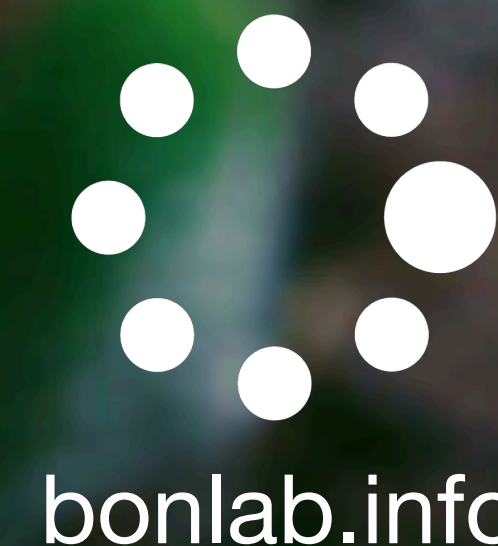
(a) Photograph of drying 100 mm<sup>2</sup> cotton squares following dipping (b) 1 mm<sup>2</sup> quadrant of dried cotton square viewed by backscattered light microscopy.



e) Column plots of fiber adhesion of smooth (cross diag.: coral) and spikey (diag. up: green). Also shown, adhesion pre (diag. down: teal) and post-wash (cross normal: purple) column plots of smooth and spikey capsules on cotton squares



SUPRACOLLOIDAL CHEMICAL ENGINEERING



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THANK YOU FOR LISTENING



Textured microcapsules through crystallization. Wilson-Whitford, S., R.; Jagers, R., W.; Longbottom, B., W.; Donald, M., K.; Clarkson, G., J.; and Bon, S., A., F. *ACS Applied Materials & Interfaces*, 13(4): 5887-5894. **2021**.

