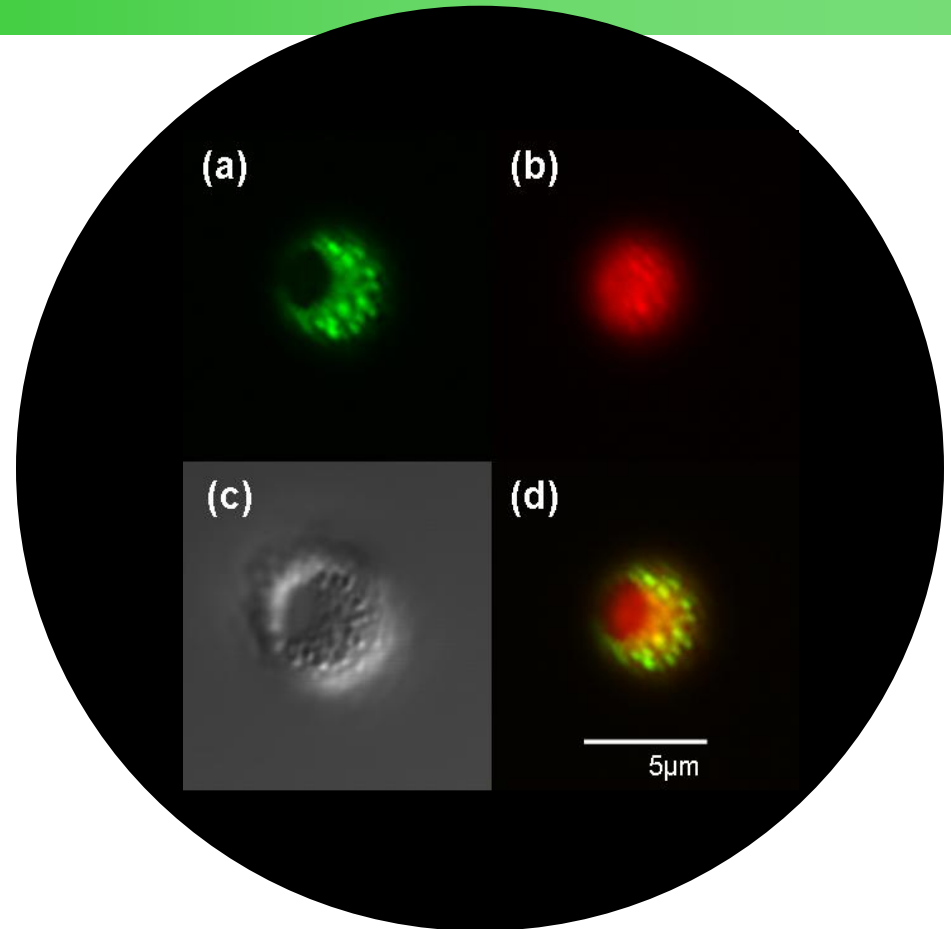
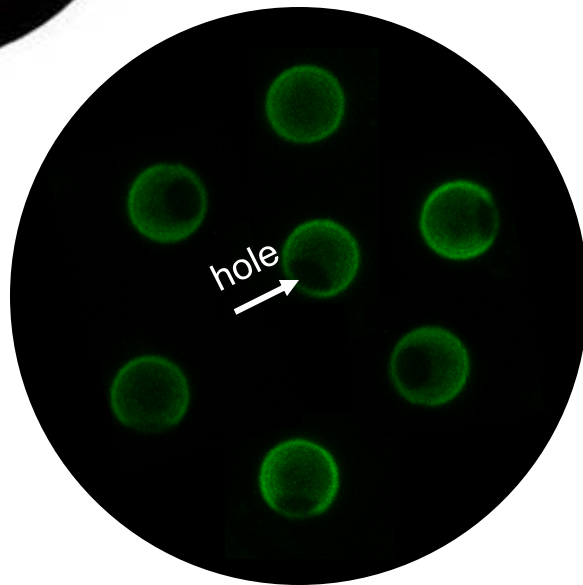
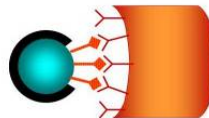


Fabrication of Stable, Anisotropic Microcapsules



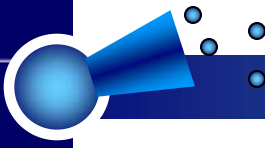
Huda A. Jerri
huda@engr.psu.edu

Advisor: Darrell Velegol
velegol@engr.psu.edu



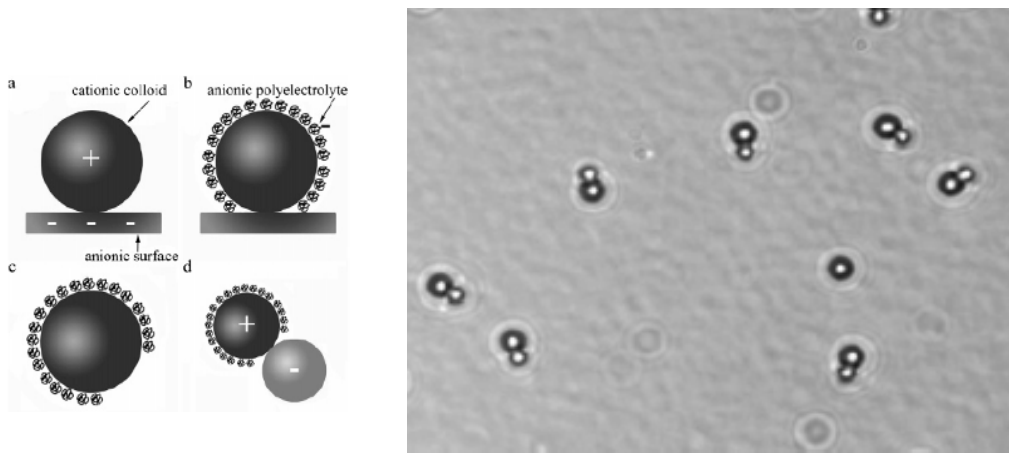
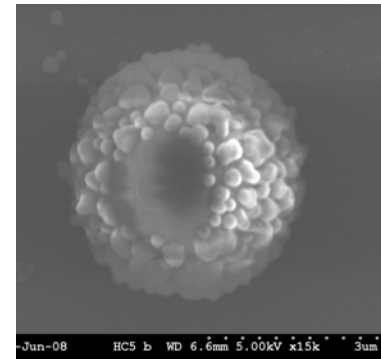
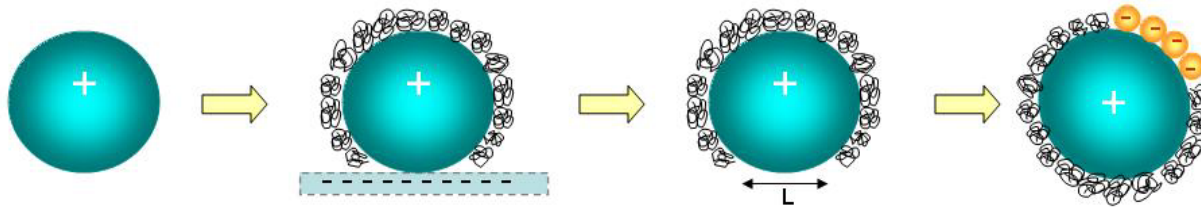
Funding: National Science Foundation (CBET Grant #0651611)



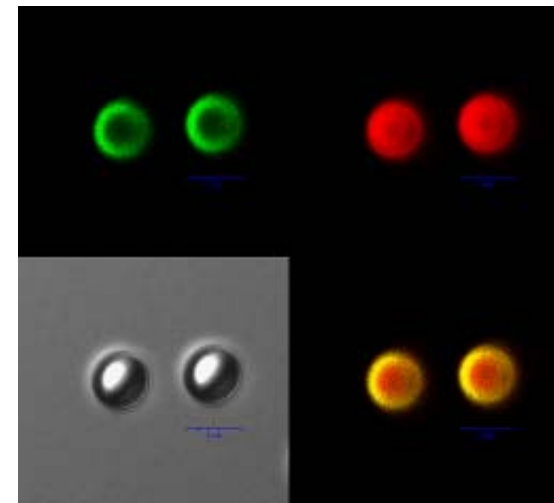


Particle Lithography Key to Anisotropic Assemblies

Dual-Functionalized Particles by Particle Lithography



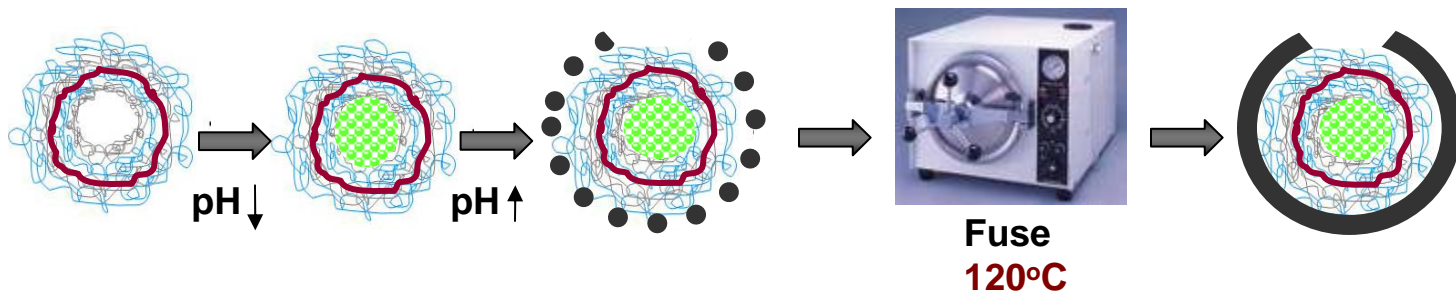
Snyder, C. et al (Velegol). *Langmuir* **2005**, 21, 4813-4815



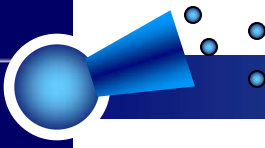
Yake, A. et al (Velegol). *Biomacromolecules* **2007**, 8, 1958-1965

Plan A: Processing Dye-Loaded Capsules

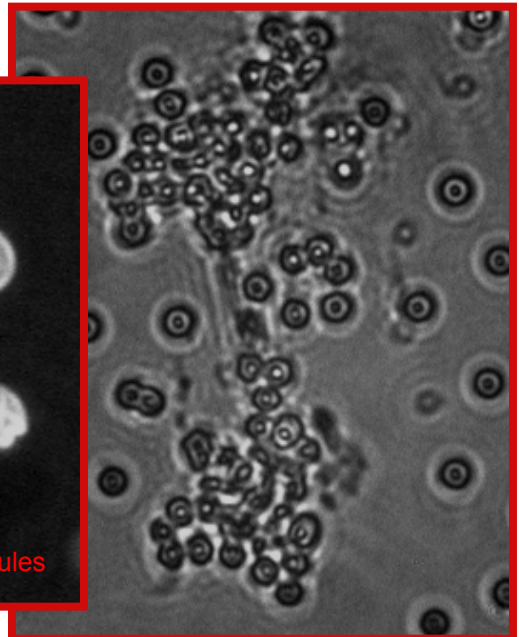
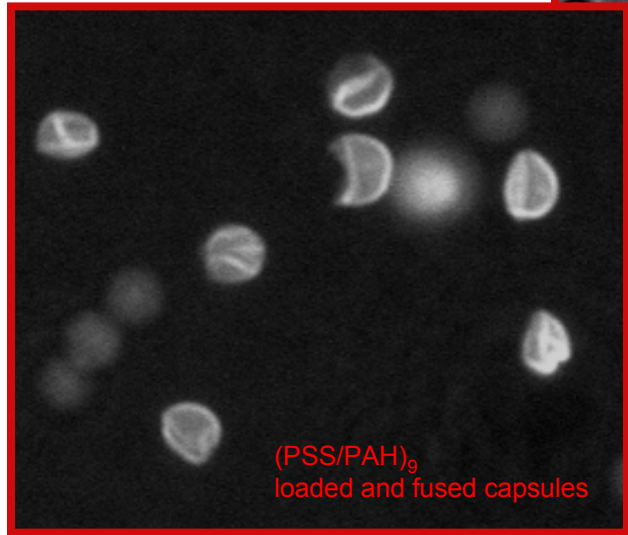
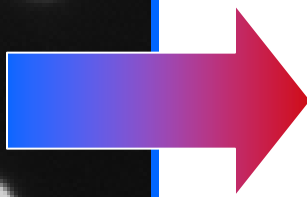
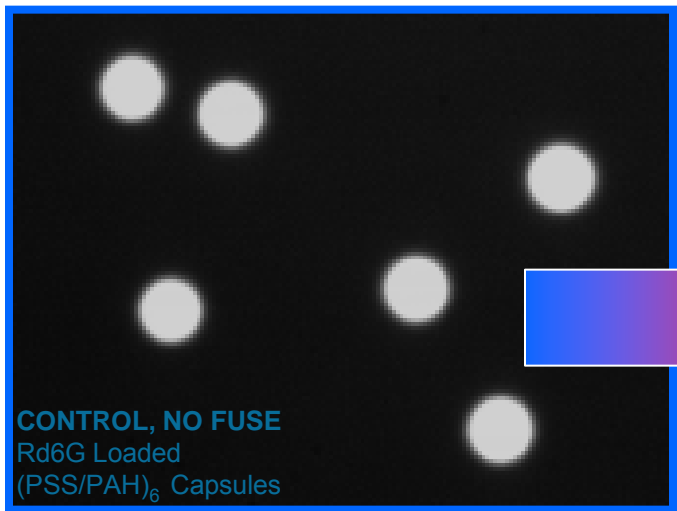
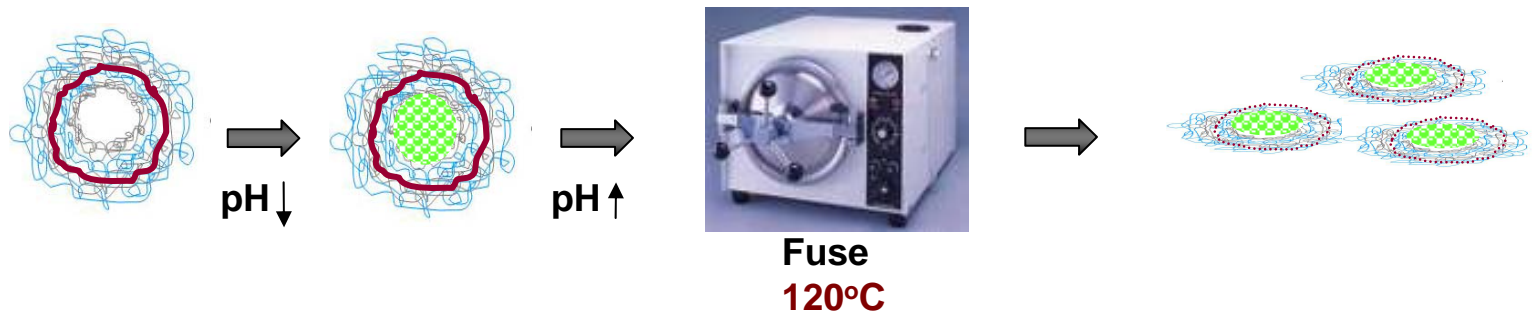
Initial Plan: form, load, settle capsules and lithograph



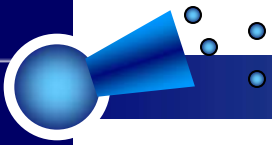
CONTROL, NO FUSE
 Rd6G Loaded
 (PSS/PAH)₆ Capsules



Many Challenges Processing Delicate Capsules

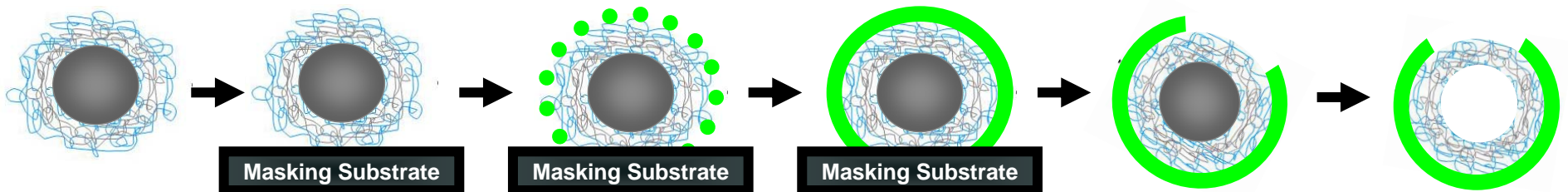
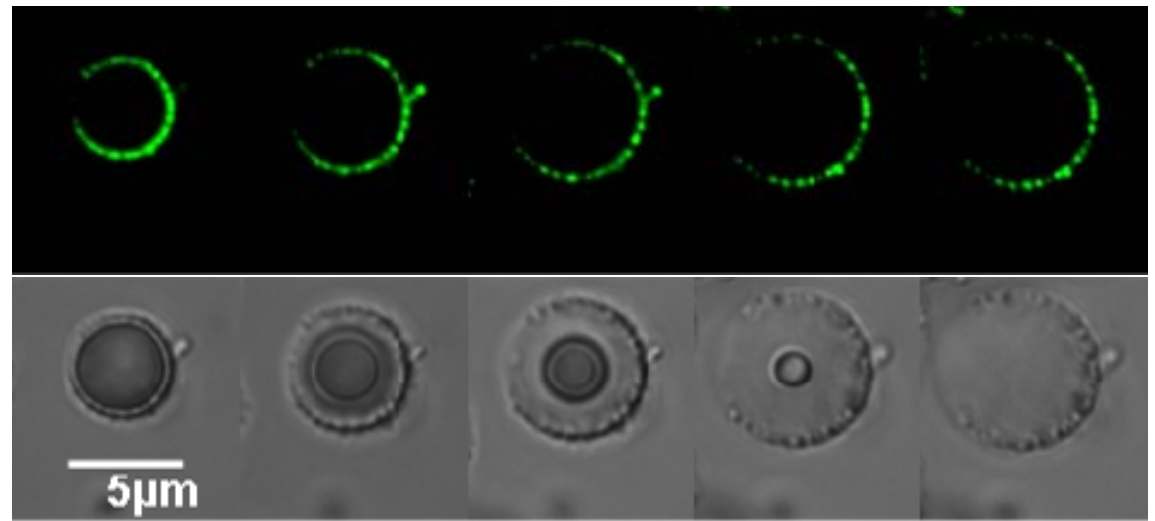
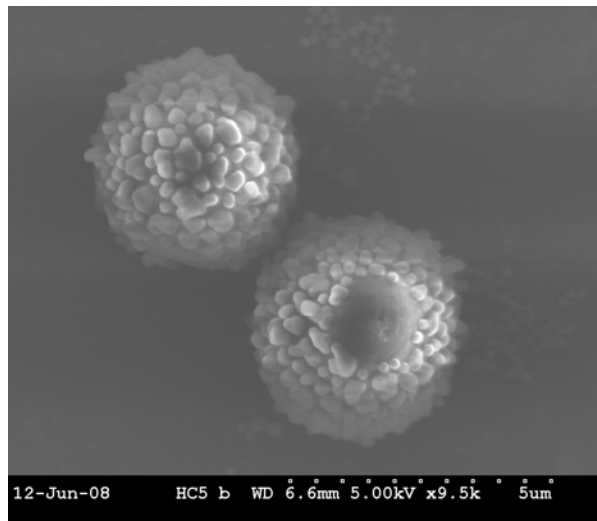


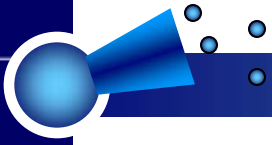
Problematic Results: Collapsed Capsules, Agglomerates, Dye unloading, Low Yields...



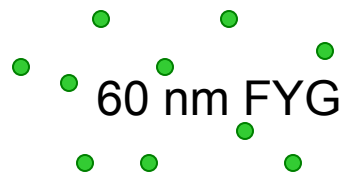
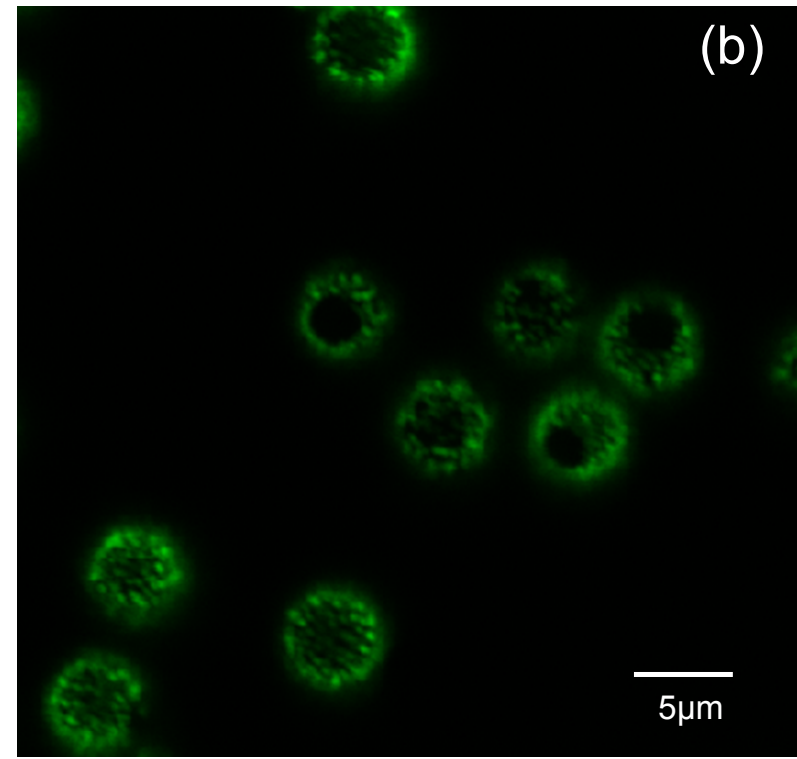
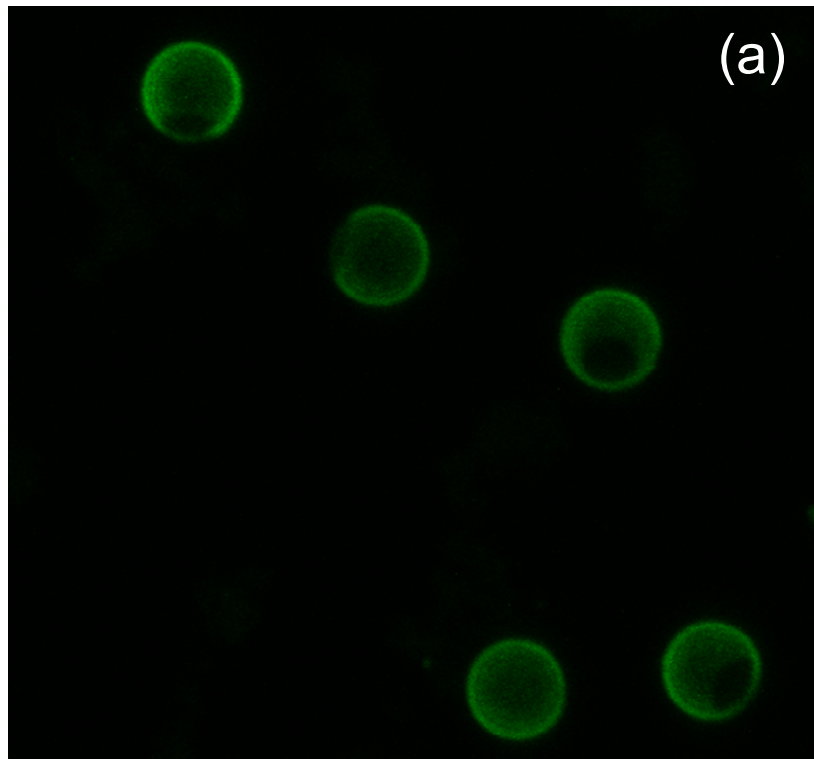
Plan B: Patched Capsules Formed Around Solid Cores

BREAKTHROUGH: Functionalize and fuse with core intact

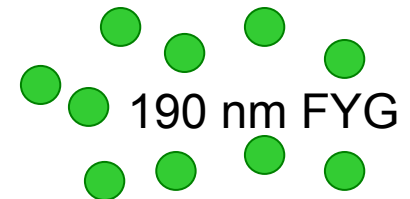


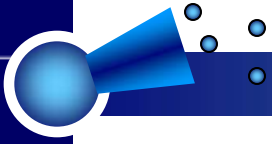


Uniform Fine and Coarse Coatings Created



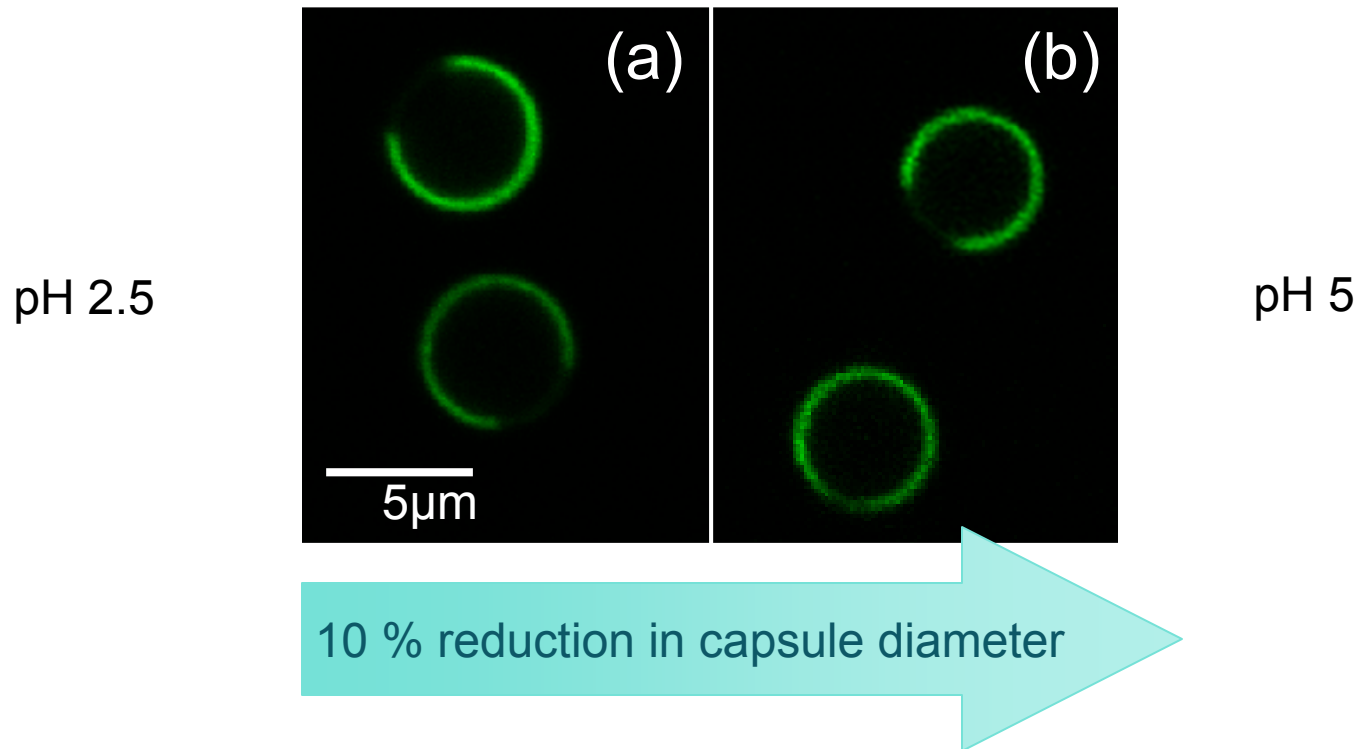
$$L = 4\sqrt{aR_g}$$

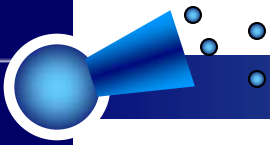




Microcapsules Swell and Shrink After Fusing

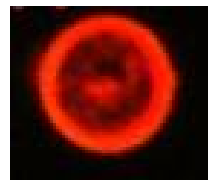
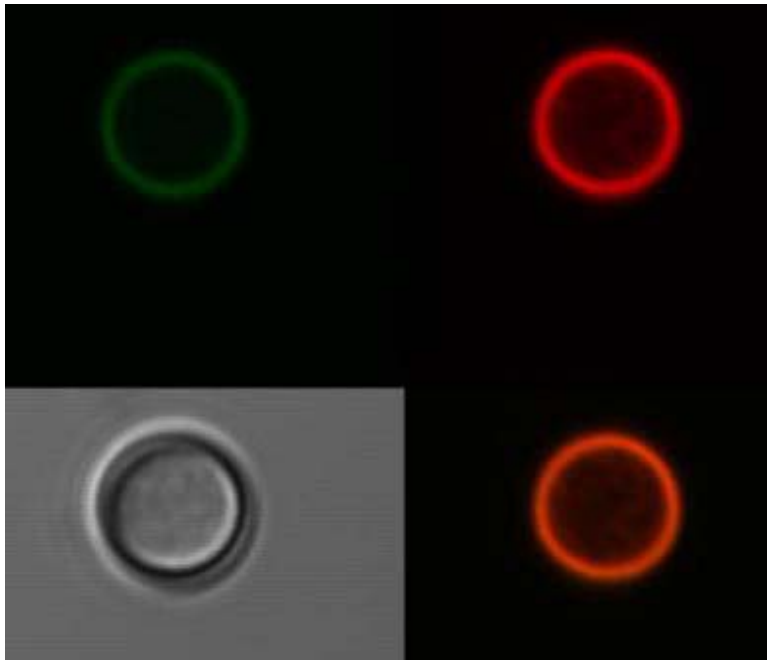
- Still pH responsive after heat treatment
- Patch and shell completely intact
- *Survive pH range 1 - 12*



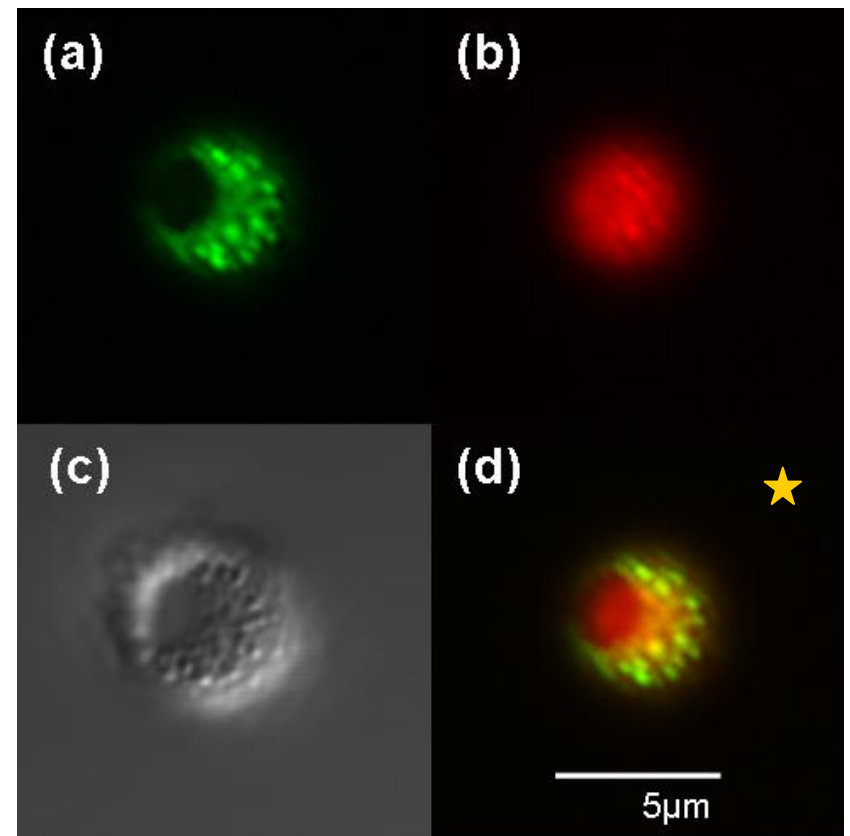


Microcapsules Retain Dye after Loading

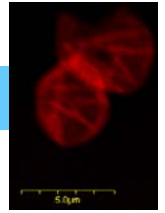
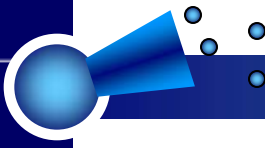
Incubate with **Rd6G**, a cationic low MW dye



Loading

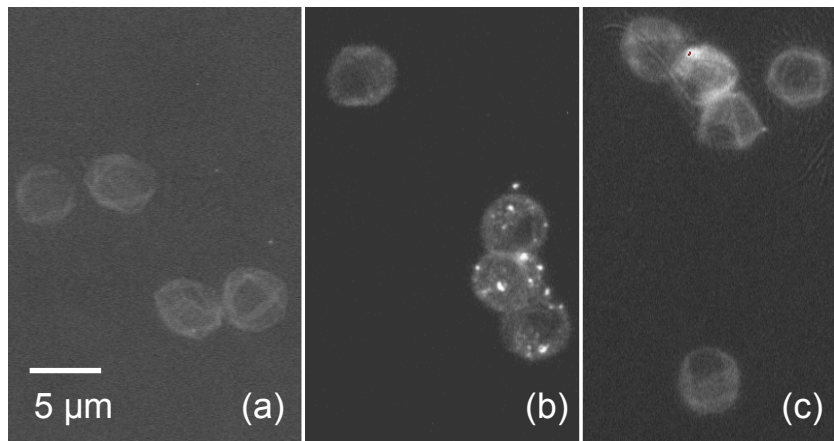


★ Overlay



Dried and Collapsed Lithographed Capsules Rehydrate

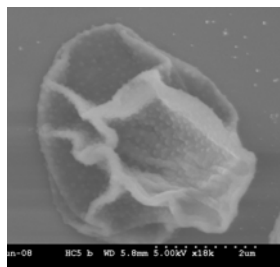
Lithographed Capsules



Dried

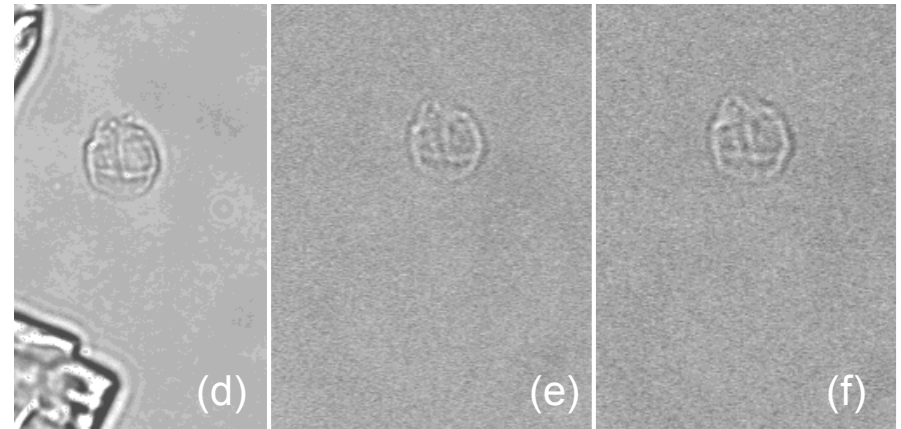
20 min

35 min



Spherical Morphology Restored

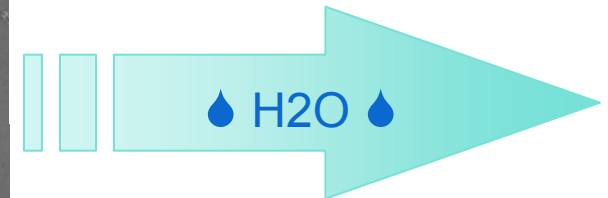
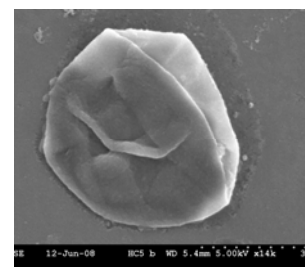
Bare Capsules Control



Dried

25 min

120 min



Still Collapsed and Adhered to Substrate