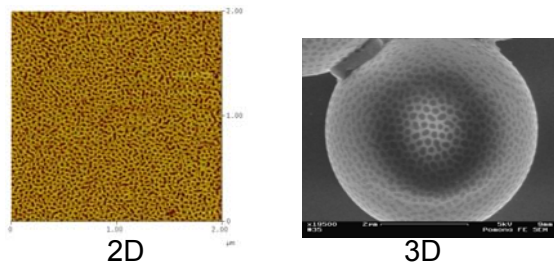


Nanoporous Whiffleballs, Golf Balls and the Future of Microscopic Sports Equipment

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Introduction: Previously in the Baker Lab, 2D nanoporous templates have been produced using Polystyrene-block-Polymethylmethacrylate (PS-b-PMMA). The phase separating characteristics of this diblock copolymer allow for a hexagonal arrangement of nanopores when spin-coated onto a 2D surface under certain conditions. This summer I attempted to reconstruct such results in a 3 dimensional environment.



Approach: Initially Si spheres, PS-PMMA, water, and toluene were combined in a vial and shaken on a shaker table for varied time periods.

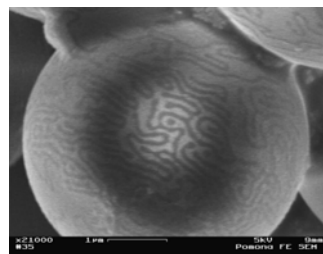
In later trials, the same materials were refluxed for various amounts of time at various high temperatures. In the high temperature experiments, the temperature, molecular weight of the polymer, reflux time, and ratio of water to toluene were varied.

Results: Found that shaking at room temperature is unreliable for uniform coating of spheres. Of the conditions examined, the optimal conditions for refluxing are at 90C for three hours with a 158K MW polymer (~70% PS). Tests for optimal UV exposure time were inconclusive. HF etch tests resulted in destroyed templates, due most likely to unstable polymer crosslinking.

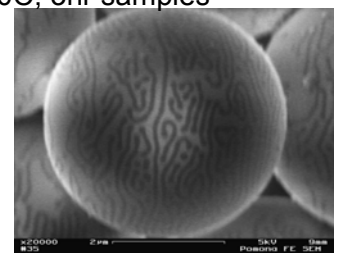
Goals: When I first began this project my goals were to create a 3D nanoporous template using SiOx spheres and PS-PMMA by uniformly coating all spheres with PS-PMMA (creating “golf balls”) and to use HF to etch away SiOx (creating “whiffleballs”)

Parameters: The parameters I wished to look at were: concentration of both H2O:Toluene and Si spheres: PS-PMMA, MW of PS-PMMA, % PS, Shaking Time, Temperature, UV Exposure

Future Work: In the future, I would like to quantify the percent of spheres coated, try more MWs at more temperatures, look at effects of concentration, retry UV experiments, and eventually refine HF etch experiments



158K, 90C, 3hr samples



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