Extending Kinetic-Controlled Polymer Templates Towards 5-10 nm Pores

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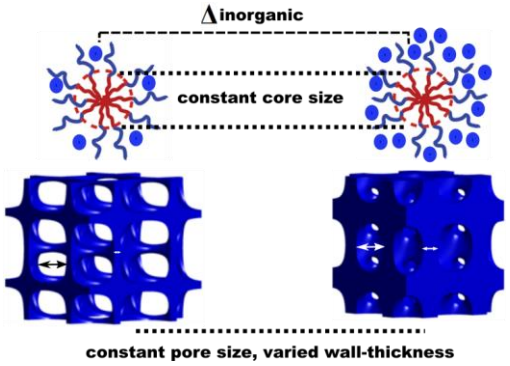

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Abstract: Controlled fabrication of nanoscale porous materials is in great demand to study the structure-property and performance relationship in advanced energy conversion and storage devices. However, the electrochemical transportation studies are somewhat hampered by the lack of systematic materials. We need a method where one can independently tune each architectural feature (pore and material wall dimension) to understand each transportation process better, for e.g., electrolyte transportation through the pore and ion intercalation through the material wall. Nonetheless, independent tuning of each architectural dimension remains elusive as it is limited under equilibrium. To address this challenge, a unique kinetic controlled self-assembly based nanofabrication technique was developed, termed as Persistent Micelle Templating (PMT), where an independent control was achieved over the pore dimension and material wall thickness while maintaining constant morphologies ("isomorphic"). In this poster we will focus on the easy identification of PMT condition employing one-pot titration approach and a combination of scattering (SAXS) model and microscopy (SEM) images from a newly designed block copolymer structure directing agent, poly(ethyleneoxide-*block*-hexylacrylate), PEO-*b*-PHA. Employing this approach tunable 6-9 nm wall-thickness was achieved with constant pore diameters of 12 nm with the atomic scale precision. Control on such a small architectural feature sizes is challenging which is resolved by PMT approach. Moreover, a conceptual framework needed to realize PMT with ~5 nm pores is in place by controlling polymer kinetics via solution thermodynamics.

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