Large scale syntheses of cooperatively assembled materials using roll-to-roll processing

Over the past 20 years, there has been tremendous progress in the synthesis of nanoporous materials with precisely controlled pore sizes and pore geometries through self-assembly. These materials enable fundamental investigations into the role of pore size and geometry on performance for diverse applications from drug delivery to battery electrodes. However generating large (>10’s of g) quantities of these materials tends to be time consuming and challenging. Here we will discuss the fundamental processes associated with standard synthesis routes for nanoporous silica and describe how we can modify the evaporation induced self assembly method to reproducibly synthesize kilograms of materials with characteristics that match those from typical batch scale that produce ~100 mg. The ability to generate large quantities of materials has enabled new material doping schemes to be developed – here we will highlight the ability to dope carbon with various heteroatoms (N, P, S, B) at relatively high loadings (>10 at%). Additionally, codoping of N,S is synergistic with nearly 40 at % N possible. We will briefly describe on how this doping of carbon impacts properties for metal sulfur batteries.

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