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Simple Fabrication of Mesoporous Silica with Remarkable High Temperature Stability at Neutral pH and Ambient Conditions from TEOS DAVID HESS, RADHA VIPPAGUNTA, JAMES WATKINS, University of Massashusetts-Amherst — Traditional silica synthesis processes can yield well ordered materials, but the synthesis conditions also lead to incomplete condensation of the silica network, which results in significant structural contraction upon calcination and limited thermal, hydrothermal and mechanical stability. Here we report the synthesis that, surprisingly, yields nearly complete condensation of the silica network (virtually all Q4 linkages) using cysteamine as the catalyst and polyoxyethylene surfactants as the structure directing agents in buffered solution at neutral pH and ambient temperature. Recently, small molecule bifunctional amines, including cysteamine, were evaluated by Morse and co-workers and found to produce silica from TEOS(JACS 2005, 127, 35). Our work combines the cysteamine catalyst system with structure-directing block copolymer surfactants at neutral pH and ambient temperature to produce mesoporous silica. The addition of tetraethyl orthosilicate (TEOS) to a solution of containing cysteamine, citrate buffer (pH 7.2) and 5wt Brij amphiphilic block copolymer (polyethylene oxide-polyethylene) yields mesoporous silica. The resulting mesoporous silica powder was analyzed using XRD, TGA, FTIR, TEM, and NMR. The materials were found to exhibit stability under extreme temperature calcinations (up to 800 C) in the presence of water. SAXS shows that 1.0 shrinkage upon calcination up to 800C. 29Si NMR analysis indicates a fully condensed silica network, Q4 linkages, in accordance with this observation.

David Hess
University of Massachusetts-Amherst

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