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Fabrication of Ordered Mesoporous Silica with Encapsulated Iron Oxide Particles using Ferritin-Doped Block Copolymer Templates D. HESS, J. WATKINS, Univ. of Mass., R. NAIK, W-P AFB — Recently, two-dimensional arrays of iron oxide clusters were fabricated by dip-coating a silica substrate into an aqueous solution. Here we report the encapsulation of ferritin in 3D mesoporous silica structures by the replication of block copolymer templates in supercritical CO_2. In our approach, preparation of the highly ordered, doped template via spincasting and microphase separation and silica network formation occur in discreet steps. A solution of an amphiphilic PEO-PPO-PEO triblock copolymer (Pluronic) template, horse spleen ferritin and a low concentration of PTSA acid was prepared and spin-coated onto a Si wafer. Upon drying the block copolymer microphase separates resulting in partitioning of the acid catalyst and ferritin to the hydrophilic domain. The polymer template was then exposed to a solution of supercritical carbon dioxide and tetraethyl orthosilicate (TEOS) at 125 bar and 40^oC. Equilibrium limited CO_2 sorption in the block copolymer template resulted in modest dialation of the microphase segregated structure. Under these conditions, the precursor was readily infused into the copolymer and reacted within the hydrophilic domain containing the acid catalyst. The resultant film was calcined in air at 400^oC for 6 hours producing a well-ordered iron oxide-doped mesoporous silica film. TEM and XRD revealed crystalline iron oxide structures within the mesoporous silica supports. Magnetic properties were analyzed using a superconducting quantum intereference device (SQUID).

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