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UVM SRC 2012—Abstract
February 2012

ABSTRACT

Mesoporous oxides have been extensively studied due to their high surface areas, tunable pore structures, large pore volumes, high thermal stability, and crystallinity. Metal oxides, more specifically, provide much promise in the fields of catalysis, sensing, and electrochemistry. The synthesis of high surface area mesoporous tungsten oxide (WO_3) spheres has been completed using a facile nanocasting technique. The WO_3 spheres are created from pre-formed mesoporous silica spheres that are approximately 1 µm in diameter. After infiltration and crystallization of the WO_3 precursor, the silica template is etched away to yield mesoporous WO_3 spheres that retain the porosity and morphology of the template. Nitrogen physisorption, powder X-ray diffraction, scanning electron microscopy, and infrared spectroscopy have been used to characterize this material. It has been determined that the successful replication of the micrometer-sized spheres depends on the size and connectivity of the template's pores. Application-based study of this material is currently underway. Compared to bulk WO_3, the WO_3 spheres possess high surface areas and large pore sizes. These physical properties allow for enhanced characteristics in applications such as water decontamination. To study the behavior of the WO_3 spheres in this application, UV/VIS spectroscopy was used to monitor the adsorption of an aromatic dye in solution. Data has shown that the WO_3 spheres adsorb approximately 98% of the original concentration of dye, while bulk WO_3 only adsorbs approximately 2% of the original concentration. The greater initial adsorption of dyes and other contaminants usually corresponds to a higher reactivity between the surface of the metal oxide and the adsorbate molecule. Applying this synthesis technique to create other shapes of mesoporous WO_3, including rod-like morphologies, has been attempted and current results will be discussed.