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Size Suppression of Metal Oxides in Mesoporous Silica Membranes for Wastewater Treatment

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Abstract

Contaminated wastewater effluent by persistent organic pollutants, particularly hazardous chemical dyes and pharmaceuticals, is a serious environmental pollution. According to USEPA, wastewater treatment plants are costing billions of dollars globally to effectively treat these contaminants, and there are still more than millions of tons of dyes and pharmaceuticals in the wastewater effluent being directly discharged into natural ecosystems, leading to long term adverse effects. This presentation will showcase our recent work in developing a new family of high-performance catalytic membrane reactors based on the discovery of single-atom metal oxides nanocomposites to completely degrade these persistent organic pollutants in a single process. In this presentation, I will discuss about our recent exciting discovery that a simple sol-gel synthesis and rapid thermal processing led to achieving a suppression of unwanted precipitation and grain growth of both single-/bi-metallic, metal oxides and maintained the atomic dispersion of metal ions with up to 25 mol% loading throughout the silica matrix. This resulted in a combination of structural homogeneity and expression of superior catalytic properties for degradation of a range of hazardous dyes leading to water reclamation for reuse.