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Forming Catalysts by Atomic Layer Deposition: from Thin Films to Nanoparticles

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Atomic layer deposition (ALD) is a method for depositing thin films of a variety of materials using an alternating series of self-limiting reactions between gas phase precursors and the substrate. Over the past several years, ALD has grown steeply in popularity as a choice for the semiconductor industry. However, ALD's real potential for impact may lie in even more novel applications, including those in alternative energy and catalysis. This presentation will describe our recent studies using ALD for the deposition of catalysts films and particles.

Three systems will be described. In the first, we apply area selective ALD to deposit a patterned Pt mesh structure that acts as an electrocatalyst and current collector for solid oxide fuel cells (SOFCs), with the goal of improving SOFC performance at low temperatures. In the second, we infiltrate high surface area carbon aerogels with a catalyst using ALD, and test the catalytic activity of this new material toward the CO oxidation reaction. In the third system, we show how surface modification can be used convert the ALD process from one depositing conformal thin films to one favoring nanoparticle deposition, with control over the surface nanoparticle density.