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“Chaos is Cheap: Aerosol Routes to Materials Synthesis”

Powders synthesized by aerosol routes are ubiquitous, found in paint, tires, and even foods. In contrast to highly monodisperse nanosized particles that can be formed by colloidal routes, particles made by aerosol processes tend to be agglomerated and fractal-like in structure. While perhaps not as pleasing to the eye, these materials are of great commercial value. In this presentation, an overview of aerosol processing for materials synthesis will be given and research activities in our laboratory will be reviewed with a focus on synthesis, characterization and performance testing of ceria based water gas shift catalysts. The water gas shift application is of interest because it is an important step in reformation of hydrocarbon fuels. By reducing the amount of carbon monoxide downstream of a partial oxidation or steam reformation reactor, CO-intolerant fuel cells can be run off of hydrocarbon based fuels, which could broaden our transportation and power generation options. In the case of ceria-based multicomponent materials, the chemical nature and location of the additional active species play a large role in catalytic functionality and process parameters during synthesis can be used to improve material characteristics and performance. Our efforts to understand structure/property/performance relationships will be discussed for the Cu/CeO₂, Ni/CeO₂ and Fe/CeO₂ systems.