11th Annual SECA Workshop Poster Abstract

Topic:

High Surface Area, Mesoporous (La, Sr)MnO_3 For Solid Oxide Fuel Cell Cathodes

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Abstract:

The efficiency of the solid oxide fuel cell is limited by the cathode polarizations. One essential approach is to include high-surface-area cathode materials into the fabrication. However, conventional synthesis methods to produce perovskites, which are commonly used for solid oxide fuel cell cathode, are known for the limited specific surface area of particles produced ($4m^2/g \sim 30m^2/g$). Therefore, as the first step, a new synthesis path needs to be developed for obtaining sufficient signals from the surface measurements. In this work, the synthesis route applied is evaporation induced self-assembly (EISA) which has been adopted in oxide synthesis but no work done on the cathode materials. In EISA, a mesoporous soft template formed with surfactants of choice is backfilled with metal precursors, and oxide powders are obtained upon calcinations at high temperatures while surfactants decomposes and oxide forms with mesoporosity that provides high surface area. The powders made are characterized by X-ray diffraction (XRD), and gas adsorption analysis, such as BET and BJH methods.

With control of the synthesis condition parameters and choice of surfactants in EISA, pure phase perovskites with specific surface area higher than conventional methods are produced ($40m^2/g \sim 50m^2/g$). The data indicates that as the precursor/surfactant ratio increases, the surface area as well increases from $4m^2/g$ to $50m^2/g$, which shows a strong relation between surface area and the ratio. Results also suggest that the powders produced with CTAB have higher surface area than the ones produced with P123. The different outcome is much related to the mesophases formed during aging. Relative humidity during the solvent evaporation step was also shown to be an essential parameter to the specific surface area of the synthesized particles. TEM images also demonstrated that the synthesized particles are mesoporous with about 10 nm pores in average. The thermal stability at operation temperature was determined.