Synthesis and electrical testing of silver-based composite electrodes for reduced-temperature solid oxide electrolysis cells

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High temperature electrolysis of steam using solid oxide electrolysis cells (SOEC) has great potential for efficient, low-carbon, and large-scale hydrogen production. SOECs are known to have more severe long-term degradation than solid oxide fuel cells (SOFC) due to accelerated solid-state materials interactions under electrolysis conditions. Lower-temperature operation mitigates these interactions due to slower diffusion and reaction kinetics. Silver is promising for use in lower temperature SOEC electrodes due to high catalytic activity and electronic conductivity, as well as low chemical reactivity with other cell components. Composite electrodes have been prepared from silver and gadolinia doped ceria (GDC) using both powder mixing and infiltration techniques. The electrodes were electrochemically tested using a symmetric cell configuration. The electrodes showed stable electrical performance at 750 °C under applied voltage of up to 0.8 V for 100 hours, but the electromigration and agglomeration of silver remains an issue under applied voltage conditions.