

Structure decoration of high performance double perovskite anode materials for SOFCs

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Abstract: Solid oxide fuel cell (SOFC) is all-solid-state energy conversion device that converts directly chemical energy stored in fuel into electricity. It is considered to be one of the cleanest and most efficient energy technologies in 21st century. Significant efforts have been devoted to developing high-performance electrode materials with the aim of increasing the power density of SOFC stacks. Ceramic anode materials have many advantages over the traditional Ni/YSZ (yttrium stabilized zirconia) in terms of reaction active site, structural stability, carbon deposition and sulfur poisoning [1]. To enhance the electrochemical activity of ceramic anode, *in situ* exsolution of highly catalytic nanoparticles and lattice tailoring strategies are employed in this work to enhance the electrochemical performance of anode materials.

A series of double perovskites $\text{Sr}_2\text{FeMo}_{0.65}\text{M}_{0.35}\text{O}_6$ (SFMM, $M = \text{Co}, \text{Ni}, \text{Cu}$) with outstanding performance are developed. Through *in situ* exsolution, several metallic nanoparticle catalysts decorated ceramics were prepared. The maximum power densities (MPD) of electrolyte supported single cells with SFMCo and SFMNi anodes reach 820, and 960 mW cm^{-2} in wet H_2 at 850 °C, respectively [2]. The SFMNi anode meanwhile shows good coking resistance in wet CH_4 . A novel double perovskite $\text{Sr}_2\text{FeMo}_{2/3}\text{Mg}_{1/3}\text{O}_{6-\delta}$ was designed and prepared. The structure study shows that the doped Mg actually takes the Fe-site, leading to the formation of a number of anti-site defects and the presence of $\text{Fe}_B\text{-O-Fe}_B$ bonds. In an electrolyte (300 μm) supported single cell, the $\text{Sr}_2\text{FeMo}_{2/3}\text{Mg}_{1/3}\text{O}_{6-\delta}$ anode demonstrates excellent cell performance with MPD of 1038 and 1316 mW cm^{-2} at 850 and 900 °C, respectively [3]. The designed double perovskites are attractive anode materials for SOFCs.

Key words: Double perovskite, Structure decoration, Electrochemical properties, Anode, SOFC

References

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