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ABSTRACT

Enhancing the Performance of Sr(Fe1-xMox)O3-δ Electrode Materials for Symmetrical Solid Oxide Fuel Cells - the Impact of Protonic Defects

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Characterized by an excellent stability under a wide range of oxygen partial pressures, good catalytic activity, and extreme versatility, the SFM-based (Sr(Fe1-xMox)O3-δ perovskites have attracted a lot of attention, especially with respect to solid oxide fuel cells technology (SOFC), including its symmetric variant (S-SOFC), where they can be used as both cathodes and anodes. However, despite their popularity, their performance, especially as air electrodes, is still inferior compared to that of more specialized cathode materials. To address this issue, as well as potentially expand the materials' utility range on the protonic ceramic fuel cells (PCFC), we doped the base SFM material with Zr and Zn, to simultenously boost the stability of protonic defects and improve overall performance. The impact of dopants is thoroughly studied for the Sr(Fe0.75Mo0.25)1-2xZnxZrxO3-δ (x ≤ 0.2) series, including the evolution of the structure, oxygen non-stoichiometry, and transport properties, under both oxidizing and reducing atmospheres. Furthermore, the proton uptake is also investigated, showing significant improvement upon doping, as well revealing a number of potentially interesting features, which could be exploited by further adjustment of the composition. Evaluation of the polarization resistances Rp shows that the selected SrFe0.6Mo0.2Zn0.1Zr0.1O3-δ material is characterized by considerably superior cathodic performance compared to SFM, with Rp value of 0.15 Ω·cm2 at ca. 740 °C, while retaining its excellent anodic properties. The DRT (distribution of relaxation times) analysis suggests, that the biggest changes in the electrode's operating mechanism are related to the dramatically more efficient adsorption process of the doped materials. Consequently, the

resulting materials seem to have considerable potential with regard to both legacy SOFC devices and the protonic and symmetrical variants.

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