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ABSTRACT:

High Entropy Oxides as Electrode Materials for Fuel Cell Technology

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The recent development of high entropy oxides (HEOx), has opened new opportunities for the development of functional oxide materials. One of the areas, where their unusual properties might be particularly valuable, are Solid-Oxide Fuel Cells (SOFCs). Despite a number of the potential advantages of SOFC technology, its widespread popularization is still hampered by their limitations, which to a large degree stems from the unsatisfactory performance of the electrode materials, especially cathodes, both in terms of the catalytic activity and broadly-understood functionality (chemical and thermal stability, thermomechanical behavior, etc.). The presented study shows the experimental evidence that the application of the multicomponent, high-entropy approach to the design of SOFC electrode materials, might enable obtaining materials of a potentially superior combination of both these features. To illustrate that, a number of different, perovskite-related HEOx systems are assessed and discussed, both in terms of their structural and functional properties, as well as their performance in symmetrical- and full-cells. The actual impact of the multicomponent configuration is also discussed, both on experimental and theoretical grounds, proving the possibility of obtaining in HEOx system properties outside of the predictions of rule-of-mixtures, while also showing that the in-depth understanding of these systems, might enable transferring at least some of their advantages into the simpler systems.
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