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EFFECT OF FUEL IMPURITIES ON SOLID OXIDE FUEL CELL PERFORMANCE: AN OVERVIEW

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Abstract

Solid oxide fuel cells (SOFCs) are a promising technology for efficient and sustainable energy generation. SOFCs provide flexibility, permitting operation on diverse fuels involving hydrogen, biogas, hydrocarbons, and syngas. However, these fuels' trace contaminants, like sulphur and chlorine, can promote performance reduction and anode degradation. In this study, a comprehensive review of the impact of fuel impurities on SOFC performance, with a focus on hydrogen sulfide (H_2S) and siloxanes, was discussed. The review comprises quantitative data on impurity concentrations and their effects on electrochemical performance. From the review, previous studies have shown that 1-20 ppm H_2S in the fuel can lead to a 10-50% voltage drop in SOFCs. At the same time, siloxanes can form microcrystalline silica deposits on the anode, causing performance degradation. Furthermore, two possible poisoning mechanisms proposed by the previous researchers were reversible adsorption-desorption and chemisorption. The review also discusses impurity mitigation solutions, such as fuel pre-treatment and removal technologies. This study enhances the understanding of impurity management and highlights the importance of effective fuel processing to optimize SOFC efficiency in real-world applications.

Key words: anode degradation, energy efficiency, fuel impurities, hydrogen sulphide, siloxanes, SOFC solid oxide fuel cells

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