CFD Modeling of Proton-Conducting Solid Oxide Electrolysis Cell for Hydrogen Sulfide Decomposition to Hydrogen

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Hydrogen sulfide electrochemical decomposition is a state-of-the-art to extract hydrogen from the hydrogen sulfide by proton-conducting solid oxide electrolysis cell without CO_2 emission. However, there is currently a lack of specialized CFD model and software for exploring the nature of the cell including temperature, concentration, and electrochemical properties.

Therefore, we propose a CFD model of hydrogen sulfide electrochemical decomposition by utilizing an open-source CFD software, OpenFOAM®. Specifically, the model implements electrochemical performances with the local Nernst equation, Kirchhoff-Ohm relationship and Butler-Volmer equations. Distributions of species, temperature and electrochemical properties were investigated with significant cell variables (e.g. current density, voltage).