World Academy of Science, Engineering and Technology
International Journal of Energy and Power Engineering
Vol:18, No:12, 2024

Internal Methane Dry Reforming Kinetic Models in Solid Oxide Fuel Cells

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Abstract : Coupling with solid oxide fuel cells, methane dry reforming is a promising pathway for energy production while mitigating carbon emissions. However, the influence of carbon dioxide and electrochemical reactions on the internal dry reforming reaction within the fuel cells remains debatable, requiring accurate kinetic models to describe the internal reforming behaviors. We employed the Power-Law and Langmuir Hinshelwood–Hougen Watson models in an electrolyte-supported solid oxide fuel cell with a NiO-GDC-YSZ anode. The current density used in this study ranges from 0 to 1000 A/m² at 973 K to 1173 K to estimate various kinetic parameters. The influence of the electrochemical reactions on the adsorption terms, the equilibrium of the reactions, the activation energy, the pre-exponential factor of the rate constant, and the adsorption equilibrium constant were studied. This study provides essential parameters for future simulations and highlights the need for a more detailed examination of reforming kinetic models.

Keywords : SOFC, dry reforming kinetics, power-law, Langmuir Hinshelwood–Hougen Watson
Conference Title : ICHET 2024 : International Conference on Hydrogen Energy and Technologies
Conference Location : Paris, France
Conference Dates : December 30-31, 2024