

2nd World Congress on Petrochemistry and Chemical Engineering

October 27-29, 2014 Embassy Suites Las Vegas, USA

Operational behavior and reforming kinetics over Ni/YSZ of a planar type pre-reformer for SOFC systems

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A solid oxide fuel cell (SOFC) is a promising all-solid-state energy conversion device that produces electricity by electrochemically combining a fuel with an oxidant across an oxide electrolyte. At ForschungszentrumJülich GmbH, a multi-component SOFC design based on a planar stack has been developed, in which all hot system components are scaled to a nominal SOFC stack power of 5 kW. To optimize the SOFC system it is necessary to investigate the effects of design and operating parameters on system components like pre-reformers and afterburners. Two special designed planar type steam pre-reformers (the first one consists of 5 layer and the other of 1 layer) on basis of nickel yttria-stabilized zirconia (Ni/ YSZ) have been built to investigate operational behavior and kinetics of steam reforming with methane. This presentation summarizes and discusses the experimental results on the global reaction kinetics of Ni-based catalyst planar pre-reformers in the temperature range between 350°C and 740°C at ambient pressure (1 bar). The species compositions of product gas at different feed compositions, flow rates and temperatures are determined by using gas-chromatographic methods and dew-point measurements. The proposed kinetic expression of Arrhenius type (second order with respect to mole fraction of methane and first order with respect to mole fraction of water) gives a good agreement with the experimental results of the methane steam reforming and is generally effective for different steam to carbon ratios. The temperature distribution in the pre-reformer and the loss of heat are also discussed.

Biography

Mr. Van Nhu Nguyen (also Nguyen Van Nhu) graduated from Martin-Luther University Halle 1975 and has completed his PhD and postdoctoral studies from Ruhr University Bochum, Germany. He has worked at the University Hanoi, Vietnam, Ruhr University Bochum, University of Cologne, Technical University Munich, RWTH Aachen University. Since 2010 he is a researcher at the ForschungszentrumJülich, Germany. He has published more than 30 papers in reputed journals. His major interests are in chemical and electrochemical engineering, applied chemical engineering thermodynamics, electrolysis and fuel cells.

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