

Kinetic of CO Methanation over a Ru supported on Al₂O₃ Catalyst

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Abstract

Proton exchange membrane fuel cells (PEMFC) have potential for generating electrical power in household use by utilizing the hydrogen-containing gas produced from natural gas or, as a perspective, from biogas via steam reforming. Since the hydrogen production is always accompanied with such a by-product as carbon monoxide, which represents a strong poison for PEMFC, its content in the operating gas has to be reduced below the threshold values as to prevent the fuel cell catalyst degradation.

Carbon monoxide methanation can be considered an attractive technique to reduce the carbon monoxide content to guarantee the long life of polymer electrolyte fuel cell systems.

Conventionally, in the course of carbon monoxide methanation of a reformat gas, three main reactions can take place. viz.: carbon monoxide methanation itself, carbon dioxide methanation and the Reverse-Water-Gas-Shift (RWGS) reaction.

In order that the purification of the hydrogen-containing gas is of high efficiency, selective carbon monoxide methanation should be performed. It can be achieved by choosing the suitable catalyst that facilitates the CO methanation, but suppresses both methanation of carbon dioxide and the RWGS reaction.

For these purposes, different catalysts have been prepared to select the most appropriate one. In the course of catalyst screening, a ruthenium based catalyst has indicated the highest activity and selectivity. A kinetic model for this catalyst including an inhibiting impact of water and carbon dioxide has been developed according to the Langmuir-Hinshelwood approach.