ELECTROCHEMICAL PROMOTION OF Ru CATALYST SYPPORTED ON YSZ SOLID ELECTROLYTE DURING DRY REFORMING OF METHANE

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ABSTRACT

The Dry Reforming of Methane (DRM) reaction has attracted great interest during the last few decades[1], as it utilizes two of the most important greenhouse gases, methane (CH_4) and carbon dioxide (CO_2) for the direct production of syngas. The majority of studies [1–4]concerning the catalytic DRM reaction have been carried out in fixed-bed and solid-oxide fuel cell type reactors operating under high temperature conditions (> 650 °C), in order to suppress the parallel Reverse Water Gas Shift (RWGS) reaction. The latter consumes the produced from the DRM reaction hydrogen for further CO production, significantly affecting the ratio of H_2/CO.

Electrochemical Promotion of Catalysis (EPOC) has been proposed as an important tool that combines Catalysis and Electrochemistry to promote a variety of catalytic reactions taking place on conductive metal-based catalysts deposited on solid electrolytes [5,6]. EPOC utilizes the application of a constant potential or current between the catalyst film and the counter electrode, both deposited on a solid electrolyte, that can lead to ion migration to and away from the catalytic surface. These ions, originating from the solid electrolyte, can effectively act as promoters that are introduced in-situ in a reversible and predictable manner and form an effective neutral electrochemical double layer over the metal/ gas interface. The latter can drastically change the properties of the catalytic surface and more specifically the work function of the catalyst which affects the chemisorptive bond strength of the reactants and intermediates. In this way, the coverage of the reactants on the catalytic surface changes resulting in the modification of the catalytic activity and selectivity of the reaction [5–7].

In this study, the electrochemical promotion of the DRM reaction under low temperature conditions is investigated using a Ru catalyst supported on YSZ (O^{2-} ion conductor), in order to in-situ affect the selectivity of the catalyst to achieve a ratio of H_2/CO as close to unity as possible (Figure 1).

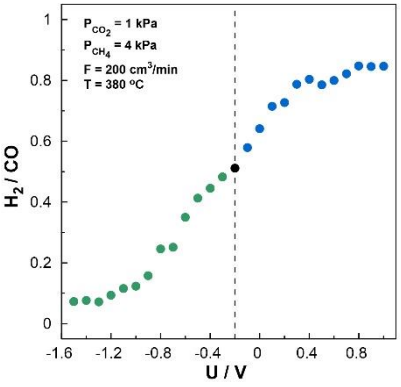

Figure 1: Effect of catalyst potential on H_2/CO ratio

KEYWORDS: EPOC, DRM reaction, RWGS reaction, H_2 Production

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