**ELECTROCHEMICAL PROMOTION OF THE CO2 HYDROGENATION REACTION OVER Pt CATALYTIC FILMS DEPOSITED ON YSZ**

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**ABSTRACT**

The global demands for energy are rapidly increasing along with population and economic growth [1]. Fossil fuels (oil, gas, and coal) cover almost 80 % of the total energy demands [2], with their use being accompanied by a harmful carbon footprint. Handling CO2, one of the main greenhouse gasses, is of vital importance for climate change mitigation. In this respect, the CO2 hydrogenation reaction is among the most effective and viable ways to manage and reduce CO2 emissions, using hydrogen generated from water electrolysis powered by renewable and sustainable sources, such as solar or wind energy [3]. The reuse of CO2 for the production of value-added hydrocarbons and therefore the promotion of renewable energy in the chemical production chain is significant [4].

Synthesis gas (syngas) production through the catalytic reverse water-gas shift (RWGS) reaction is an attractive option for the conversion of CO2 to fuels. Many metal-based catalysts have been introduced for this reaction in order to provide high activity, CO selectivity, and stability.

Pt has been extensively studied as useful RWGS reaction catalyst. Pt catalyst promote the RWGS reaction in lower-temperature regions, compared to the reactions performed using other metals, such as Cu (>500 °C). In addition, Pt possess high activity and selectivity, and hence, it is one of the most promising catalysts for the RWGS reaction [5].

The Electrochemical Promotion of Catalysis (EPOC) phenomenon has been studied extensively for many catalytic reactions including hydrocarbon oxidation reactions and hydrogenations. The EPOC effect is based on the modification of the work function of a metal, which also serves as working electrode, leading to an alteration in the chemisorption bond strength of the reactants. This effect is observed when small currents or potentials are applied to a catalyst deposited on a solid electrolyte [6, 7].

In the present study the Electrochemical promotion of the carbon dioxide (CO2) hydrogenation has been achieved over a Pt catalyst film deposited on Yttria-Stabilized-Zirconia (YSZ), an oxygen conducting solid electrolyte disc. The effect of applied potential is non-Faradaic, with apparent Faradaic efficiency values up to 10.

**KEYWORDS:** EPOC, CO2 hydrogenation, Pt catalyst, RWGS

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