**WIRELESS ELECTROCHEMICAL PROMOTION OF CATALYTIC REACTIONS USING LOW TEMPERATURE SOFCS. THE CASE OF CO2 HYDROGENATION**

**A. Lymperi1, C. Chatzilias1, E. Martino1, C. Vayenas1,2, G. Kyriakou1, A. Katsaounis1,\***

1University of Patras, Department of Chemical Engineering, Caratheodory 1 St, 26504, Patras, Greece

2Academy of Athens Panepistimiou 28 Ave., 10679, Athens, Greece

 *\* alex.katsaounis@chemeng.upatras.gr*

**ABSTRACT**

The reaction of CO2 hydrogenation has attracted the interest of the scientific community worldwide both as a potential source of renewable fuels and as a mean of reducing carbon dioxide emissions. Thus, this reaction can offer advantages, such as the deterrence of the galloping increase of CO2 in the atmosphere and simultaneously changing partially its form to useful fuels (e.g., methane, methanol). During the last decades, the majority of the studies concerning the catalytic hydrogenation of CO2 have been carried out in fixed-bed reactors using noble metals such as Pt, Rh and Ru [1].

In parallel, Electrochemical Promotion of Catalysis (EPOC) has been applied to the same catalytic reaction in order to improve the catalytic activity and selectivity of conductive films deposited on solid electrolytes [2, 3]. EPOC has been used to promote metal-catalyst films simultaneously acting as electrodes, deposited on solid electrolyte supports, such as yttria stabilized-ZrO2 (YSZ, an O2− conductor) [2]. Upon application of a change, ΔUWR, to the electrical potential, UWR, of the catalyst (working electrode) with respect to a reference electrode these backspillover species, accompanied by their compensating charge in the metal, migrate to the metal-gas interface, creating an overall neutral double layer, termed the effective double layer. This ion backspillover causes the catalyst work function, Φ, to change by ΔΦ=eΔUWR and accordingly the chemisorptive bond strengths of the reactants and intermediates are modified. Thus, both catalytic activity and selectivity are affected in a pronounced, reversible, and, to some extent, predictable manner [3, 4].

Although EPOC has been effectively applied in numerous catalytic systems [5–9], one of the main drawbacks related tο the difficulties in the configuration design due to the necessary connections between the supported electrodes inside the reactor and the external potentiostat/galvanostat. Both previous disadvantages could be managed if the catalytic reaction takes place in a reactor, which simultaneously could operate as a power generator. Herein, we present a novel design of a low-temperature SOFC reactor where the demanded power for the modification of the reaction catalytic rates is directly obtained by the parallel oxidation of hydrogen. CO2 hydrogenation is used as a case study reaction.

**KEYWORDS:** EPOC, SOFC, CO2 Hydrogenation

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