

Electrochemical Promotion of Catalysis:  
Recent Developments  
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The use of Electrochemistry to activate and precisely tune the catalytic activity of metals and metal oxide catalyst-electrodes in contact with solid and aqueous electrolytes has been described in the literature for more than seventy catalytic reactions [1]. The phenomenon is known as electrochemical promotion of catalysis (EPOC) or non-Faradaic electrochemical modification of catalytic activity (NEMCA effect, Fig. 1). [1-3]

In this work we present and analyze some recent experimental and modeling results which address:

- The relationship between electrochemical and classical promotion [4].
- The relationship between electrochemical promotion and the phenomenon of metal-support interactions in heterogeneous catalysis (Fig. 2), where the absolute potential of the supports is found to play an important role [5, 6].
- The recently established rules of electrochemical and chemical promotion [4, 7].

It is concluded that electrochemical promotion, chemical promotion and metal-support interactions with conducting supports can all be treated as catalysis in presence of a double layer at the metal-gas interface. In the case of electrochemical promotion, this double layer is *in situ* controllable via potential application. This conclusion is strongly supported by numerous *in situ* spectroscopic and electrochemical techniques.

## REFERENCES

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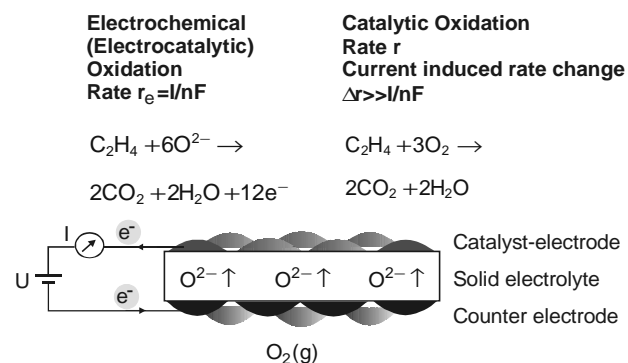


Fig. 1. Experimental setup and operating principle of electrochemical promotion of catalysis using an  $O^{2-}$  conductor.

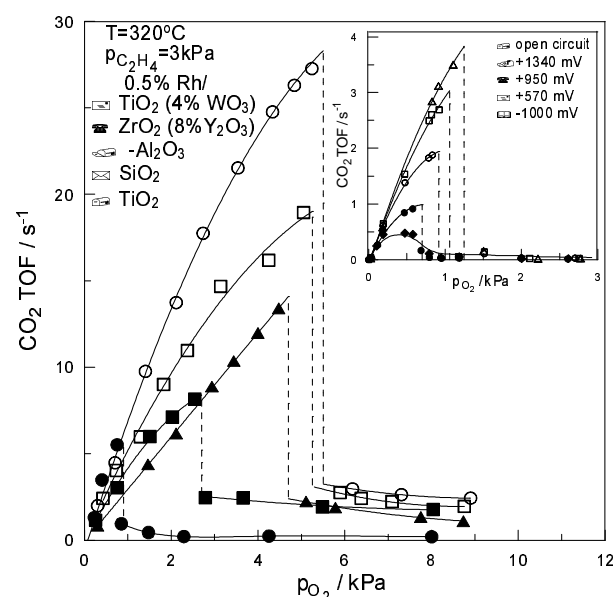


Fig. 2. Equivalence of electrochemical promotion and metal-support interactions. Effect of  $p_{O_2}$  on the rate (TOF) of  $C_2H_4$  oxidation on dispersed Rh nanoparticles supported on five supports of increasing work function  $\Phi$ . Catalyst loading 0.5wt%. Inset: Electrochemical promotion of a Rh catalyst film deposited on  $Y_2O_3$ -stabilized- $ZrO_2$  (YSZ): Effect of potentiostatically imposed catalyst potential (and work function change [1]) on the catalytic rate (TOF) dependence on  $p_{O_2}$  at fixed  $p_{C_2H_4}$ .

