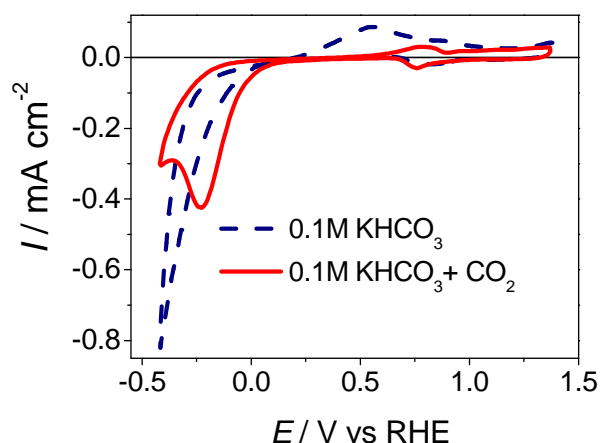


CO<sub>2</sub> Electroreduction at Pd/Au(111) and Pd/Pt(111)  
MultilayersAneta Januszewska, Rafał Jurczakowski, Paweł Kulesza  
University of Warsaw, Department of Chemistry  
ul. Pasteura 1, 02-093 Warsaw, Poland

Atmospheric carbon dioxide levels have risen rapidly over the last few decades. Electrochemical conversion of carbon dioxide into eligible fuels has potential as a technology that may prevent from a serious environmental problem. Electroreduction of carbon dioxide to hydrocarbons is a complex process that usually involves adsorbed carbon monoxide as an intermediate. Hence, the overall electroreduction path is determined to a large extent by the catalyst's surface affinity to carbon monoxide; strongly bounded CO inhibits further reduction while weakly bounded CO easily desorbs and becomes the final product. The presence of adsorbed atomic hydrogen at the catalyst surface may significantly facilitate the formation of hydrocarbons. Geometric and electronic modifications of pseudomorphic Pd overlayers affect both CO [2] and hydrogen adsorption [3]. Here we report the results of electrochemical studies on CO<sub>2</sub> electroreduction at thin palladium overlayers deposited on well defined Au(111) and Pt(111) surfaces. This low index orientation was chosen because Pd(111) reduces CO<sub>2</sub> to adsorbed CO whereas atomically flat Pt(111) surface is inactive in this reaction [1]. Results indicate that both the substrate and the layer thickness (studied within the range 0.8-50 ML) significantly change the catalytic activity of palladium toward CO<sub>2</sub> electroreduction.

Figure 1 shows the comparison of cyclic voltammograms obtained in pure and CO<sub>2</sub> saturated KHCO<sub>3</sub> solution for 5ML Pd/Au(111). In the absence of CO<sub>2</sub> saturation, hydrogen absorption is followed by hydrogen evolution reaction starting at +0.05V, in anodic cycle a broad peak resulting from hydrogen desorption can be observed at 0.55V. After CO<sub>2</sub> saturation the electroreduction process lead to the formation of peak with onset at 0.15V and maximum current at -0.23V. The reaction is coupled with hydrogen evolution. Hydrogen desorption current observed in anodic potential scan is markedly lower which indicate that hydrogen was consumed in CO<sub>2</sub> electroreduction.



**Fig.1** Cyclic voltammograms registered in pure and CO<sub>2</sub> saturated 0,1 M KHCO<sub>3</sub> for 5 Pd ML deposited on Au(111), scan rate  $\nu = 20 \text{ mVs}^{-1}$

## References:

- [1] N. Hoshi, Y. Hori, *Electrochimica Acta* 45 (2000) 4263
- [2] A.M. El-Aziz, L.A. Kibler, *J. Electroanal. Chem.*, 534 (2002) 107
- [3] H. Duncan, A. Lasia, *J. Electroanal. Chem.*, 621 (2008) 62