

## Methanol oxidation reaction on electrodeposited Pd and SbPd electrocatalysts in alkali metal hydroxide solutions

Milica G. Košević<sup>1</sup>, Nebojša D. Nikolić<sup>1</sup>, Jelena D. Lović<sup>1</sup>

<sup>1</sup>University of Belgrade, ICTM–Department of Electrochemistry, Belgrade, Serbia

Electrochemistry in alkaline solution is substantial for the examination on electrooxidation of liquid fuels [1]. Recently, alkaline direct alcohol fuel cells (ADAFCS) have shown the interest of researchers due to their advantages in performance and cost of materials, as an important characteristics for the commercialization of fuel cells. Within this context, Pd-based catalysts are attracting a great deal of attention as catalysts for the methanol oxidation reaction (MOR) in alkaline solution. Some metals may have a promoting effect on electrooxidation of alcohols and among them is antimony [2]. We report the galvanostatic preparation of Pd and bimetallic Sb–Pd catalyst from a surfactant free electrolyte. The bimetallic catalyst was obtained in two-step electrochemical deposition route with electrodeposition of Sb (the first step) followed by Pd electrodeposition (the second step). Aim of the work is to examine the role of Sb in the bimetallic Sb–Pd catalyst as well the impact of the selected alkali metal cations on the electrocatalytic activity of Pd and Sb–Pd electrocatalysts in MOR. In order to understand the correlation between the morphology and electrocatalytic activity of Pd and Sb–Pd catalysts, they were analysed by scanning electron microscopy (SEM) technique.

The electrocatalytic activity of Pd and Sb–Pd catalysts for MOR was evaluated by CV technique in 1 M NaOH and 1 M LiOH as displayed in Fig. 1. The shift in the initial oxidation potential along with two-fold increase in peak current density observed on Sb–Pd catalyst demonstrates that bimetallic electrode have higher catalytic activity than Pd catalyst. It is clear that the MOR activity is affected by the presence of Sb most probably due to the hasctronic modification of Pd induced by Sb.

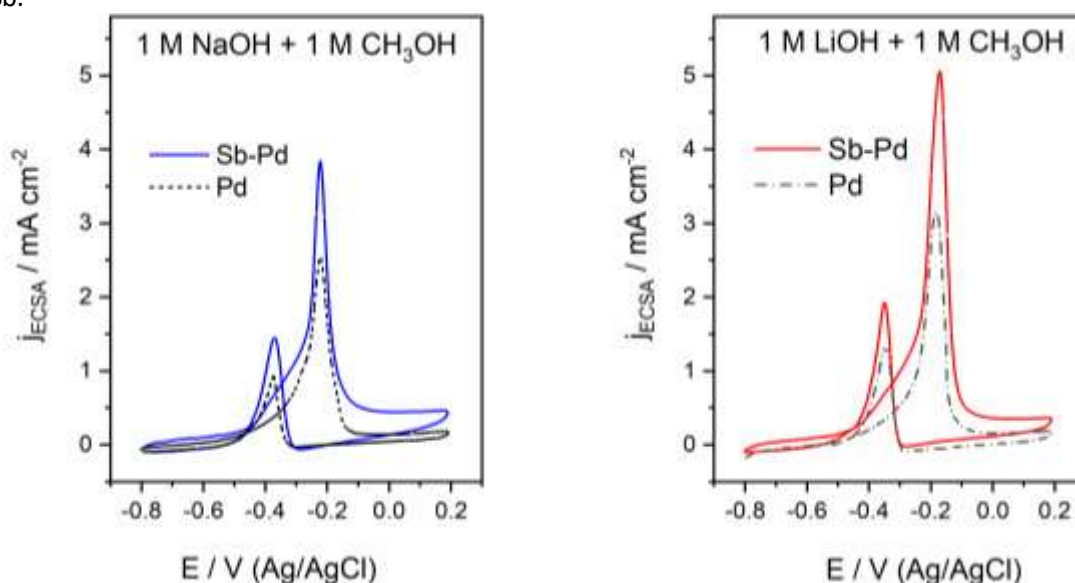


Figure 1. CVs for the electrochemical oxidation of 1 M CH<sub>3</sub>OH at Pd and Sb–Pd in 1 M NaOH and 1 M LiOH at  $v = 0.05 \text{ Vs}^{-1}$ .

Inspection of the results presented in Fig. 1 reveals the importance of the selection of alkali metal hydroxide for MOR. Electrochemical oxidation of methanol starts at rather negative potentials in LiOH solution in regard to NaOH indicating the active role of OH<sub>ad</sub> and impact of the nature of alkali metal cations. It was stressed that the choice of alkali metal cations govern the electrocatalytic activity and can be considered as one of the tuning parameters in electrocatalysis. Taking into account the role of Sb in bimetallic catalyst it was observed that Sb adjusts the extent and persistence of OH<sub>ad</sub> surface coverage combining at the same time the contribution of the cation in solution. It can be concluded that Sb–Pd electrocatalyst possess excellent electrochemical characteristics and has a potential in methanol fuel cell application.

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### References

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