

OXYGEN REDUCTION IN ALKALINE SOLUTION ON PALLADIUM COATINGS PREPARED BY GALVANIC EXCHANGE OF COPPER

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In recent years there have been multitude of studies trying to enhance the catalytic activity and stability of Pd-based catalysts for the oxygen reduction reaction (ORR). Study of Pd in given context is driven by an urge to reduce the amount of Pt used in fuel cell applications [1]. In this work electron-beam deposited copper layers (0.5–10 nm) on a glassy carbon (GC) electrode were galvanically replaced by Pd in a H_2PdCl_4 solution bath [2]. Obtained thin Pd layers were characterised physically using X-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM) and electrochemically using the rotating disc electrode (RDE) method in addition to cyclic voltammetry (CV). RDE was applied in O_2 saturated 0.1 M KOH solution for the study of the ORR kinetics. Remnant copper was detected for 5 and 10 nm but was not on the 1 and 2 nm sacrificial layer thicknesses using the energy dispersive X-ray spectroscopy (EDX). No copper was detected with the use of XPS and CV on any of the Pd layers. SEM studies on the Pd films showed uneven growth of the film with larger particles and voids covering the GC surface. Typical spherical particles obtained by electron-beam evaporation method could not be observed [3]. Sacrificial layer thickness did not influence the specific activity of the Pd films for the ORR. Oxygen reduction on the obtained films proceeded through 4-electron pathway. Tafel analysis showed rate-limiting step to be the transfer of the first electron to the O_2 molecule, with slopes of -60 mV which is typical to surface oxide covered Pd [1].

References

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