Proc. of the Intl. Conf. on Nanotechnology for Better Living, 2016
Editors K. K. Kar, A. Shah and R. Sharma
Vol. 3, No. 1, p. 123
doi:10.3850/978-981-09-7519-7nbl16-rps-123

Novel $Co(OH)_2$/Au composite as electrocatalyst for alcohol electro-oxidation

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Direct alcohol fuel cells (DAFCs) have great promise for meeting in a unique way the current energy demand. Methanol, the simplest alcohol with a single C-C bond has been studied well. Toxicity issues associated with methanol have led researchers to investigate less toxic alcohols such as ethanol (EtOH), ethylene glycol (EG) and isopropanol (IPA). Despite being heavy alcohols these alcohols show immense potential as they have high energy density. But, breaking C-C bonds of such heavy alcohols is not possible by using conventional catalysts. Development of potential catalysts that are effective, both cost and performance wise, is a big challenge for alcohol oxidation. Here, we report a novel $Co(OH)_2$/Au composite for electro-oxidation of polyhydric alcohols. In this study the electrocatalytic activity of the composite for alcohol oxidation is investigated.

XRD and EDS confirm the formation of $Co(OH)_2$/Au composite. SEM images reveal the presence of Au in the form of highly agglomerated grains in the $Co(OH)_2$ matrix.

Electrocatalytic activity of $Co(OH)_2$/Au composite in 1 M KOH was done along with that for $Co(OH)_2$ and Au for comparison. A pair of redox peak were observed for $Co(OH)_2$ and $Co(OH)_2$/Au which indicate the oxidation of Co(II) to Co(III) [1, 2]. An additional redox peak indicating the oxidation of Co(III) to Co(IV) was observed in $Co(OH)_2$/Au composite [3]. The peak current for $Co(OH)_2$/Au composite in 1 M KOH is only 4 mA. Interestingly, the CVs of composite material in 1 M EtOH, 1 M EG and 1 M IPA shown in Figure 1 show increased peak current density than in 1 M KOH. The increased peak current density indicates that alcohol electro-oxidation has taken place.

Chronoamperometry (CA) studies further substantiate the CV data. IR data of the products formed after electro-oxidation was obtained and the presence of C=O peak observed at 1730 cm^{-1} confirms that the alcohols have undergone oxidation and have formed respective acids. Detailed characterization and electrocatalytic studies will be presented.

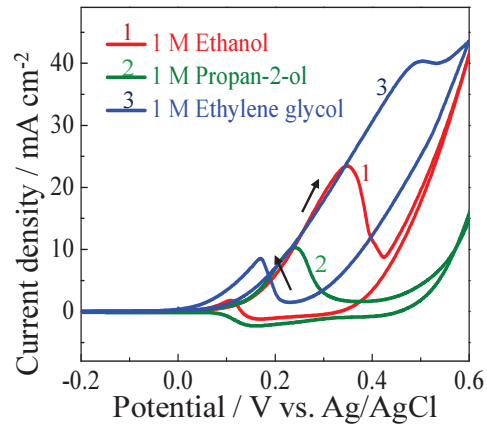

Figure 1: CV for $Co(OH)_2$/Au in 1 M EtOH, 1 M EG and 1 M IPA

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