Electrochemical oxidation of ammonia using electrodeposited Pt on carbon substrate as catalyst in ammonia electrolysis

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Electrochemical oxidation of ammonia attracted great interest about wastewater treatment in environmental electrochemistry, as well as direct ammonia fuel cells and hydrogen production.[1] That’s because ammonia has high hydrogen storage capacity and high energy density than other fuels, especially no contribution of carbon-balance.[2] However, due to the kinetic limitation of ammonia electro-oxidation, some groups try to improve that problem depending on the type of catalysts.

Herein, we report on preparation of electrode through electrodeposition of Pt nanostructures on carbon substrate by applying various potentials. Unlike other approaches, this approach shows that activity of electrochemical oxidation of ammonia associates with morphology and crystallinity.[3] The surface morphologies were characterized with a SEM and structural analysis of Pt was carried out using XRD, respectively. To investigate real surface area of electrodeposited Pt, cyclic voltammograms (CVs) were recorded in KOH and NH₃. With that approach, we tried to apply electrodeposited Pt electrode to zero-gap cell to produce hydrogen from ammonia electrolysis.

The morphologies of the electrodeposited Pt on carbon substrate with various applied voltages are investigated using the SEM images. As applied potential increases, the morphology of Pt is changed from dendrite structure to smooth and their particle size become smaller. CVs in KOH and NH₃ solution were performed to evaluate electrocatalytic activity of electrodeposited Pt on carbon substrate. We found that cauliflower-like structure shows better activity of ammonia oxidation than that of dendrite structure and hydrogen adsorption and desorption area is varied with morphology of Pt (Fig. 1).

REFERENCE


Figure 1. Electrochemical behavior of electrodeposited Pt electrodes: Cyclic voltammograms in KOH and NH₃ (vs. Hg/HgO) (a) cauliflower-like structure and (b) dendrite structure.