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AMMONIA OXIDATION ON SQUARE-WAVE TREATED PLATINUM DEPOSITED ON BORON-DOPED DIAMOND ELECTRODES

Abstract

Ammonia is considered as sustainable fuel and can be used as a clean energy carrier. Ammonia can be obtained either from fossil fuels, biomass, or other renewable sources [1]. The production of ammonia is easier than hydrogen. In comparison to hydrogen, ammonia is less expensive cost per unit of storage energy. Ammonia is comparable with gasoline in terms of higher volumetric energy density. Commercially, ammonia is more viable in terms of handling and distribution compared with hydrogen. Their environmental compatibility becomes the most attractive energy sources and promising from technological and environmental perspectives. Frequently noble metals are used for ammonia oxidation. Platinum is widely used for ammonia oxidation. Platinum nanoparticles are used for electrochemically oxidize ammonia. The oxidation reaction of ammonia has been reported as shape-dependent electrocatalysis [2]. Ammonia oxidation on platinum surface almost exclusively takes place on platinum containing (100) sites [3]. In our experiments, platinum is electrodeposited onto boron-doped diamond (BDD) films by cyclic voltammetry. The electrodeposited platinum nanoparticles are treated with square wave voltammetry to produces a structural change. Constantly, platinum nanoparticles are oxidized and reduced during square wave voltammetry. This process creates new platinum ion that is then reduced creating changes in sites of platinum. Platinum grows through nucleation with a continuous dissolving of the original platinum. These small platinum nanoparticles grow more rapidly than the larges ones. Platinum crystals could changed by periodic adsorption and desorption of oxygen depending on their Miller indices [4]. Scanning electron microscopy (SEM) images show superficial changes to platinum nanoparticles after square wave voltammetry. The square wave voltammetry treatment reduces the quantity of platinum electrodeposited onto BDD films. Although the reduction of quantity of platinum, these platinum nanoparticles square wave treated show an enhancement for ammonia oxidation.

References: (1) Zamfirescu, C.; Dincer, I. Journal of Power Sources 2008, 185, 459-465. (2) Vidal-Iglesias, F. J.; Solla-Gullón, J.; Rodrıguez, P.; Herrero, E.; Montiel, V.; Feliu, J. M.; Aldaz, a. Electrochemistry Communications 2004, 6, 1080-1084. (3) Garc, N. Electrochemistry Communications 2003, 5, 22-26. (4) Tian, N.; Zhou, Z.-Y.; Sun, S.-G.; Ding, Y.; Wang, Z. L. Science (New York, N.Y.) 2007, 316, 732-5.