A Facile Electrochemical Method to Prepare Pt Disk Electrode with (100) Preferential Orientation for Investigating Structure-Sensitive Electro-Oxidation Reactions

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doi: 10.20964/2016.06.28

Received: 9 March 2016 / Accepted: 30 March 2016 / Published: 4 May 2016

A square-wave voltage was used to electrochemically treat the Pt disk electrode with 5 mm diameter in H₂SO₄ solution by a two-electrode cell. The surface preferential orientation of a Pt disk electrode can be controlled by the lower potential limit and the frequency of the square-wave voltage. The lower potential limit of −2.4 V and the frequency of 2000 Hz resulted in the formation of (100)-oriented Pt surface on the disk electrode. Hydrogen desorption profile suggested the significantly increased proportion of Pt(100) sites in the electrochemically treated Pt disk electrode. Four typical and important structure-sensitive electro-oxidation reactions were selected for investigating the electrocatalytic activity of Pt electrodes. Electrochemically treated Pt disk electrodes exhibited much higher specific activities for the electro-oxidation of ethanol and ammonia, and revealed lower specific activity for formic acid electro-oxidation, which agrees well with previous studies on Pt(100) single crystal electrodes. The above results suggest that the electrochemical treatment method can be used as a very facile and one-step way to prepare model Pt disk electrode with well-defined (100) preferential surface orientation for the investigation of the structure-sensitive reactions.

Keywords: platinum; electrochemical treatment; electro-oxidation; structure-sensitive; square-wave voltage.

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