Oxygen Reduction Reaction at in Situ Fabricated Active Gold Over Layers in Acidic Media

Md. Rezwon Miah^{1,*}, Takeyoshi Okajima², Takeo Ohsaka^{3,*}

¹ Department of Chemistry, School of Physical Sciences, Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh

² Department of Chemical Science and Engineering, School of Materials and Chemical Technology, Tokyo Institute of Technology, 4259-G1-5 Nagatsuta, Midori-ku, Yokohama 226-8502, Japan

³ Research Institute for Engineering, Kanagawa University, 3-27-1 Rokkakubashi, Kanagawa-ku, Yokohama 221-8686, Japan

*E-mail: mrmche@yahoo.com, pt120866sa@kanagawa-u.ac.jp

doi: 10.20964/2016.09.30

Received: 13 May 2016 / Accepted: 1 July 2016 / Published: 7 August 2016

Hydrous gold (Au) oxide, on polycrystalline Au (Au (poly)) electrode was *in situ* electrogenerated by multi-potential step amperometric (MPSA) technique between 2.2 V and 0.8 V with pulse time 0.001 s at each potential in 0.5 M H₂SO₄ solution for different times between 5-60 s. Electrodes with active gold over layers (agol) on the Au (poly) electrode (agol | Au (poly)) were generated by electroreduction of the hydrous Au oxide formed by MPSA technique. The agol | Au (poly) electrodes were characterized by reductive desorption of cysteine self-assembled monolayer (Cyst-SAM) and oxidative stripping of electrodeposited Pb. The *in situ* fabricated agol | Au (poly) electrode surface was found to be enriched in Au(100) and Au(110) domains as compared with the untreated Au (poly) electrode. Oxygen reduction reaction at the agol | Au (poly) electrode was carried out in 0.5 M H₂SO₄ solution. A significant catalysis of the ORR was achieved. The catalytic properties were explained in terms of crystalline domains and roughness factor of the Au electrode.

Keywords: Hydrous Au oxide; Active gold over layers; Roughness factor; Single crystalline domain; Oxygen reduction reaction

[FULL TEXT](#)

© 2016 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).