

## Studies on Electrodeposition of RuO<sub>2</sub> for Supercapacitor

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The electrodeposition of RuO<sub>2</sub> is considered as a very useful method to make the contact between the electrode material and electrolyte optimize, to reduce the amount of precious ruthenium, and to control the amount of deposition exactly and easily. In order to prepare the hydrated amorphous RuO<sub>2</sub>, several electrochemical methods were used. The shapes of RuO<sub>2</sub> prepared by electrodeposition did not depend on the kinds of applied power sources but depend on the surface conditions of substrates.(Fig. 1) Since the deposition film was consisted of the small RuO<sub>2</sub> grains, despite the film thickness of *ca.* 40 nm, it showed higher specific capacitance of *ca.* 740 F/g. In order to understand the electrodeposition phenomenon, several techniques such as CV, CA, EQCM and XPS were used. From the results of these investigations, it can be concluded that the RuO<sub>2</sub> was deposited directly in the oxidation potential region of 950 ~ 1000 mV.(Fig. 2) However, even though the amount was small, the ruthenium species were observed at the all electrodes which were prepared with CA experimental at the potential regions of -200 ~ 800 mV. In addition, it can be found that with just dipping the electrode into the plating solution for 5 seconds, ruthenium species can be observed in CV experimental. From the results of EQCM in condition of OCV, it was revealed that these phenomena resulted from the adsorption strength of ruthenium species on the electrode. XPS analysis also confirmed that the ruthenium species could be adsorbed on the electrode at all of the potential regions of -200 ~ 1000 mV, and especially the ruthenium species that was deposited at the potential of 1000 mV was a RuO<sub>2</sub>.(Fig. 3)

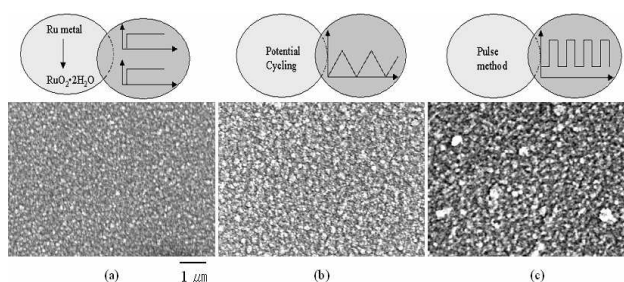


Fig. 1. Influence of the different power sources for the electrodeposition of RuO<sub>2</sub> on an ITO glass (a) potential step (b) potential cycling (c) potential pulse.

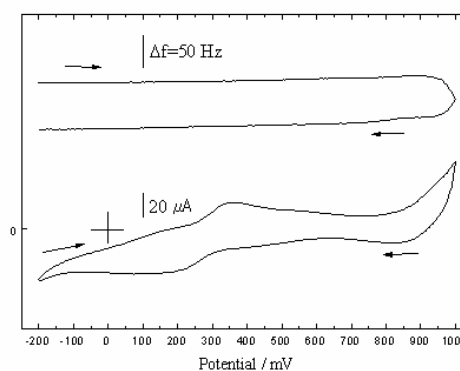


Fig. 2. CV and EQCM experimental for the electrodeposition of RuO<sub>2</sub> between -200 and 1000 mV (a) 2<sup>nd</sup> cycle (b) 30<sup>th</sup> cycle.

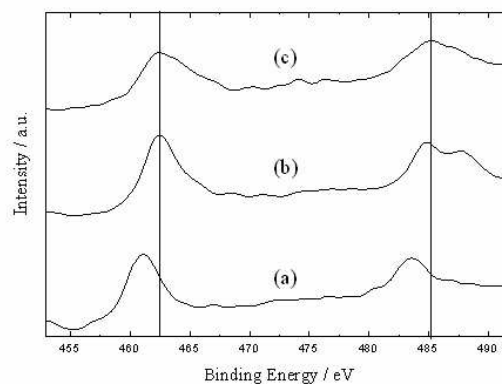


Fig. 7. Ru 3p<sub>3/2</sub> and 3p<sub>1/2</sub> peaks of the ruthenium metal and prepared samples. (a) ruthenium metal, (b) RuO<sub>2</sub> prepared by potential cycling method, (c) RuO<sub>2</sub> prepared by potential pulse method.

