

Preparation of rhodium oxide thin films by reactive sputtering and their electrochromic properties.

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[Background] Electrochromic (EC) materials change their optical transmittance (colored and bleached) reversibly on application of a low voltage. A typical EC device consists of an EC layer, an ion-conduction layer, and an ion-storage layer, all sandwiched between two transparent conducting electrodes. Platinum group metal oxides, such as iridium (Ir) oxide and specific rhodium (Rh) oxide, are considered to be promising EC materials because of their high chemical stability. However, studies on the EC properties of Rh oxide are very scarce. In this study, rhodium oxide thin films were deposited by reactive sputtering, and their structure and EC properties were evaluated.

[Experimental] Rh oxide thin films were prepared by reactive sputtering using a Rh metal target (99.9% purity, 2 in. diameter disk) in O₂ or H₂O atmosphere on glass, Si, and ITO-coated glass substrates. The RF power, substrate temperature, and sputtering gas pressure during the deposition were 50W, room temperature (RT), and 50mTorr, respectively. The sputtering gas flow rates of O₂ and H₂O gases were kept constant at 2.5 ccm. EC properties of Rh oxide thin films deposited on ITO glass were measured in 1M KOH aqueous electrolytes.

[Result and discussion] Fig. 1 shows cyclic voltammograms of Rh oxide films deposited in O₂ and H₂O atmosphere measured after 100th cycles. The current density of the film deposited in H₂O was larger than that in O₂. Fig. 2 shows the transmittance spectra of films in bleached and colored states obtained by applying constant voltages of -0.1 and +0.5 V (vs Ag/AgCl reference electrode) for 1 min. The width of the transmittance changes of the films deposited in H₂O atmosphere was larger than that deposited in O₂.

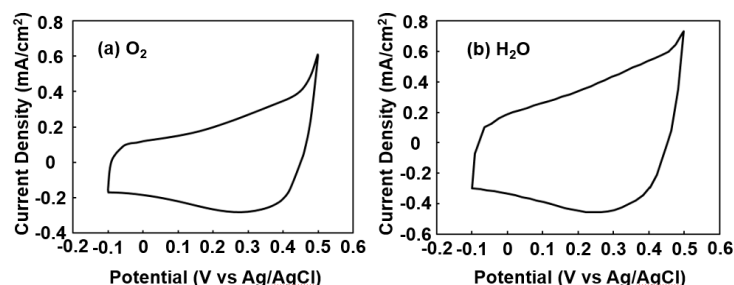


Fig. 1 Cyclic voltammograms of films prepared at RT in O₂ or H₂O.

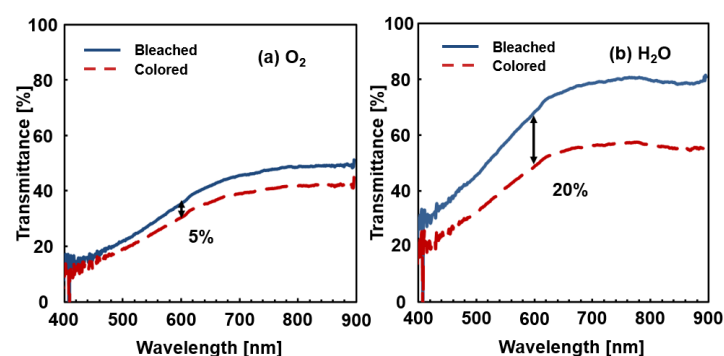


Fig. 2 Bleached and colored transmittance spectra of films prepared in O₂ or H₂O.

In conclusion, it is found that Rh oxide thin films deposited in H₂O atmosphere have good EC properties.