

Characterization of electrodeposited nano-Structured cerium-based mixed oxide films for electrochromic device

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Mixed oxide films of CeO₂ and transition metal oxides [1] have recently attracted great interest because of their excellent properties suitable for transparent counter electrode in electrochromic devices[2]. We attempted to prepare thin films of Ce-Co mixed oxides by electrodeposition previously [3]. In this report, we examined various cerium-based mixed oxide films in order to improve electrochemical properties.

0.01M Ce(NO₃)₃ + 0.01M Co(NO₃)₃ mixed solution and 0.01M Ce(NO₃)₃ + 0.01M Co(NO₃)₃ + other transition metal salt solution are used as electrolytes. The temperatures, current forms and current densities are varied. The characteristics of the film was examined by TEM, XRD, IR and UV-Vis spectroscopy. Cyclic voltammograms of the films in 0.05M NaOH solution were measured using a potentiostat with a function generator. A glassy carbon and Ag/AgCl electrode were used as counter and reference electrodes respectively.

Model clusters [4] of cerium-based mixed oxides, Ce_xMyO_z were analyzed by molecular orbital calculation using Software SCAT[4]. It was elucidated that electrochemical and optical properties of the electrodeposited films were strongly correlated with the partial density of states of model clusters.

Thin films consisting of Ce and Co oxides are prepared by cathodic electrodeposition from Ce(NO₃)₃ and Co(NO₃)₃ mixed aqueous solution. The TEM images of the Ce and Co deposits indicate that the film consists of CeO₂ nano-crystals in amorphous matrix. From IR spectra of the mixed films revealed a new peak at 767 cm⁻¹ that existed neither CeO₂ nor Co(OH)₂. The Ce-Co mixed oxide films co-electrodeposited at 30°C provided highest transmittance (about 0.9) in visible region.

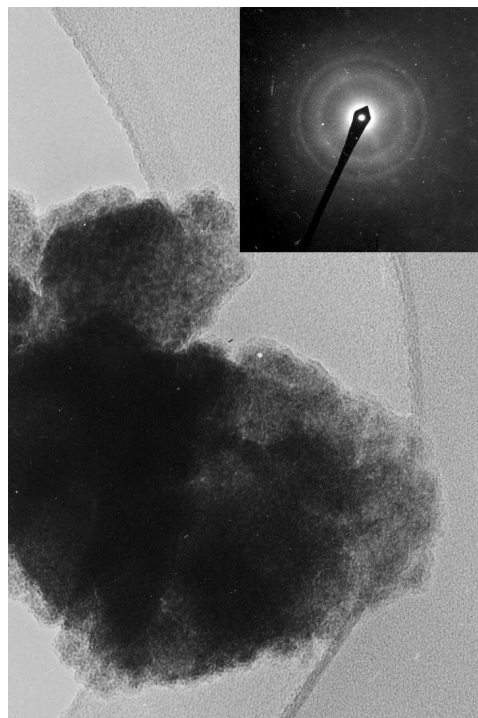


Figure 1. A typical TEM micrograph of co-electrodeposited Ce and Co mixed oxide film

References

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