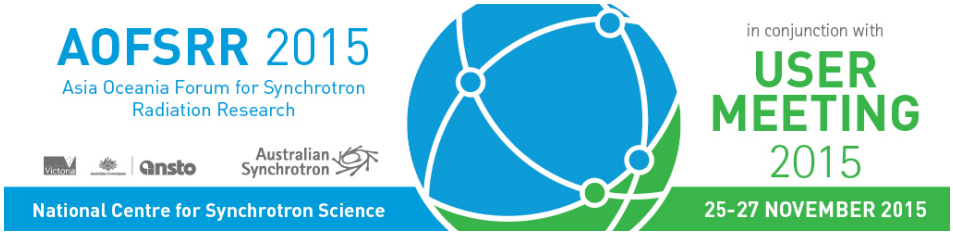

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In-Situ Investigation of Electrodeposited Manganese Dioxide Thin Film Electrodes using Powder Diffraction

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Manganese dioxide has proven to be an excellent electrode material for electrochemical capacitors due to its high capacitance, low cost and low toxicity. In particular, thin film electrodes have been shown to exhibit extremely high capacitance values, which may be attributed to their low resistance and good electrolyte accessibility.

Anodic electrodeposition of manganese dioxide from an acidic solution of Mn2+ ions has produced electrodes with specific capacitance in excess of 2000 F/g. However, it has often been observed that the capacitive performance of thin film electrodes decreases significantly as film thickness increases. This effect has been partially attributed to the decrease in specific surface area that occurs with longer deposition times, but is also expected to be affected by other material properties such as crystal structure.
In this work, the crystal structure of manganese dioxide films was examined in-situ using powder diffraction. Manganese dioxide films were deposited anodically from a solution of MnSO4 in H2SO4 (of varying concentrations) for up to 3 hours. The effect of deposition conditions on the crystal structure was determined and the films were performance tested to identify any relationship between the material structure and the capacitive performance. These results will lead to a better understanding of how the deposition conditions can be tailored to optimise the performance of electrodeposited thin films.

Consequently, an understanding of the deposition mechanism and its effects on the crystal structure are vital for improving the performance of electrodeposited manganese dioxide electrodes.

Keywords

electrochemical capacitors, manganese dioxide, electrodeposition, thin films

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