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Synthesis and characterization of manganese dioxide for high electrochemical performance supercapacitor electrode

In this study, manganese dioxide (MnO2) was synthesized by hydrothermal method using different urea (CO(NH2)2) of No Urea, Urea 0.0686 mL, Urea 0.686 mL, and Urea 6.86 mL. Crystal structure of synthesized MnO2 was evaluated by X-ray diffraction technique to be delta-MnO2 structure (No Urea and Urea 0.0686 mL) and alpha-MnO2 structure (Urea 0.686 mL and Urea 6.86 mL). Morphology of delta-MnO2 and alpha-MnO2 structures show a nanoflower and a nanorod shape, respectively. The specific capacitance of four MnO2 electrodes in a 1 M Na2SO4 electrolyte are 118.40, 108.77, 60.30, and 41.15 F g-1 at a current density of 0.3 A g-1, for No Urea, Urea 0.0686 mL, Urea 0.686 mL and Urea 6.86 mL MnO2 electrodes, respectively. The No Urea MnO2 electrode gives the highest specific capacitance due to its largest pore size of 25.04 nm. The charge/discharge mechanism of electrodes could be explained by energy dispersive spectroscopy. It was found that SO42- ions are attracted to the MnO2 electrode surface at charging state from 0.0 V up to 0.9 V. In contrast, the SO42- ions move away from the MnO2 electrode surface at discharging state from 0.9 V to 0.0 V.

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