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Specific capacitance–pore texture relationship of biogas slurry mesoporous carbon/MnO_2 composite electrodes for supercapacitors

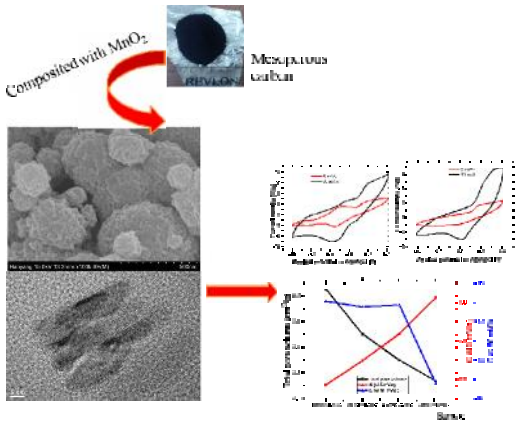
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highlights

- Precise MnO_2 loading afforded high specific capacitance (709 F g^{-1}) materials.
- Texture properties modulation strongly influences electrochemical performance.
- Capacitance-texture properties correlation is predominant at high scan rates.
- Pseudocapacitance was more pronounced in the negative potential.

graphical abstract



article info

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abstract

Here, we report synthesis of biogas slurry mesoporous carbon/MnO_2 composites by simple co-precipitation route followed by thermal treatment at 250 °C for 6 h. The texture, morphology, crystal structure, and microstructure of the composites are investigated by nitrogen sorption studies, FESEM, HRTEM, X-ray diffraction, and Raman spectroscopy. All samples exhibit type IV isotherms. The BET surface area decreased from 514 to 110 $m^2 g^{-1}$ while total pore volume decreased from 0.52 to 0.17 $cm^3 g^{-1}$ for samples loaded with 2×10^{-5} and 2×10^{-3} moles of Mn. The electrodes fabricated exhibit high specific capacitance of 709 F g^{-1} at scan rate of 5 mV s^{-1}. The specific capacitance at scan rate of 5 mV s^{-1} increases with increasing MnO_2 content. However, at 50 mV s^{-1}, specific capacitance decreases with increasing MnO_2 content. Varying the MnO_2 content and hence the textural parameters, strongly influences the specific capacitances of the composite electrodes.

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