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Hierarchical Porous Carbon Composite Electrode for High Performance Supercapacitor Application

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Abstract : This study developed a simple hierarchical porous carbon (HPC) synthesis process and used for supercapacitor application. In which, mesopore provides huge specific surface area, meanwhile, macropore provides excellent mass transfer. Thus the hierarchical porous electrode improves the charge-discharge performance. On the other hand, cerium oxide (CeO2) have also got a lot research attention owing to its rich in content, low in price, environmentally friendly, good catalytic properties, and easy preparation. Besides, a rapid redox reaction occurs between trivalent cerium and tetravalent cerium releases oxygen atom and increase the conductivity. In order to prevent CeO2 from disintegration under long-term charge-discharge operation, the CeO2 carbon porous materials were was integrated as composite material in this study. For in the ex-situ analysis, scanning electron microscope (SEM), X-ray diffraction (XRD), transmission electron microscope (TEM) analysis were adopted to identify the surface morphology, crystal structure, and microstructure of the composite. 77K Nitrogen adsorption-desorption analysis was used to analyze the porosity of each specimen. For the in-situ test, cyclic voltammetry (CV) and chronopotentiometry (CP) were conducted by potentiostat to understand the charge and discharge properties. Ragone plot was drawn to further analyze the resistance properties. Based on above analyses, the effect of macropores/mespores and the CeO2/HPC ratios on charge-discharge performance were investigated. As a result, the capacitance can be greatly enhanced by 2.6 times higher than pristine mesoporous carbon electrode.

Keywords : hierarchical porous carbon, cerium oxide, supercapacitor
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