Heteroatoms Doped Hierarchical Porous Carbon Materials for High Performance Supercapacitor Electrodes

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Hierarchical porous carbon materials (HPC) based on sulfur-urea-formaldehyde resins have been prepared with different size of silicas as templates, following by carbonization and alkaline etching. When tested in 6 M KOH, the storage capacitance of HPC is as high as 625 F g⁻¹ at 1.0 A g⁻¹, showing excellent rate capability (288 F g⁻¹ at 10 A g⁻¹). Furthermore, HPC possess remarkable electrochemical cycling stability (less than 4.0% loss after 5000 cycles) when tested at 10 A g⁻¹. At the same time, the energy density (*E*) of HPC was 12.5 and 44.6 Wh kg⁻¹ at the power density (*P*) of 288 and 300 W kg⁻¹ with the electrolytes of 6 M KOH and 1 M LiPF₆ in EC/DEC at the corresponding test systems illustrating this materials has potential practical application potential. The superior capacitive performances resulted from its high surface area, hierarchical micro/meso/macroporous structures and heteroatoms doping of the HPC, which providing the ideal storage capacity, fast transport speed of electrolyte ions, and outstanding synergistic effect of doped heteroatoms. These results demonstrate that the HPC electrode materials with unique pore structure and chemical composition hold particularly promising prospect as supercapacitors.

Keywords: hierarchical porous carbon materials; heteroatom doping; supercapacitors; specific capacitance; rate capacity

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