Template-free fabrication of pitch-based carbon nanosheets with tunable mesopores by mild modification for all-solid-state supercapacitors

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Abstract: Simultaneous control of the microtopography and pore texture of carbon materials without using templates receives particular attention in the past few years. Herein, honeycomb porous carbon nanosheets with tunable mesopores are fabricated from cheap pitch extract (β-resin) through sequential solvent extraction-mild modification (using hydrogen peroxide and rosin)-activation (using potassium hydroxide) process. The oxygen-containing groups generated promote β-resin molecules to crosslink forming large planar macromolecules, while the incorporation of rosin structure into the molecules contributes to an adjustable molecular spacing, avoiding excessive stacking, which in turn affects the development of narrow mesopores during their activation. The honeycomb porous carbon nanosheets exhibit well-defined honeycomb porous nanosheet features and rich tunable mesopores specific in sizes of 2~5 nm. By virtue of the peculiar architecture, the honeycomb porous carbon nanosheets show an ultra-high specific capacitance of 305 F g^{-1} at a high current density of 50 A g^{-1}. As-assembled symmetrical flexible all-solid-state supercapacitor exhibits a high energy density of 11.21 W h kg^{-1} at a power density of 498 W kg^{-1}, as well as an excellent cyclic performance over 50,000 cycles.