OR0604

Microwave Plasma-assisted Chemical Vapor Deposition of 3D-Crosslinked Porous Carbon Film as High-rate Supercapacitor Electrodes

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Highly porous carbon film (PCF) on nickel foam was prepared successfully by microwave plasma-assisted chemical vapor deposition (MPCVD) with C2H2 as carbon source and Ar as discharge gas. The PCF is uniform and dense with 3D-crosslinked nanoscale network structure conformably coated on nickel foam, and possesses large specific surface area and high degree of graphitization, advantageous to electrical conductivity, ion contact and electrochemical stability, when used as the binder-free electrode material in an electrochemical supercapacitor. The electrochemical test results showed that the PCF prepared under the microwave power of 1000 W has an excellent electrochemical performance. It displays the specific capacitance of 62.75 F/g in 30% KOH aqueous solution with the current density of 2.0 A/g, and the specific capacitance remained 69% of the initial when the current density increased to 10.0 A/g. Besides, near-rectangular shape of CV curves exhibit typical characters of an electric double-layer capacitor and show high-rate capability due to its enhanced ionic diffusion and transportation ability.

Keywords
Porous carbon film
Double-layer supercapacitor
Microwave plasma
Chemical vapor deposition
high-rate capability