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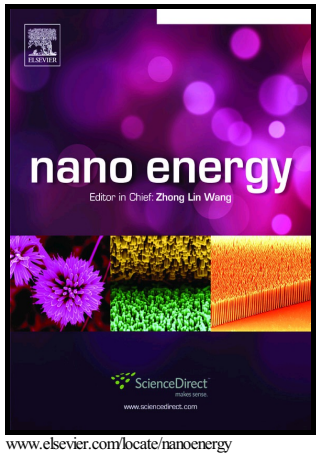

Full Lithographic Fabrication of Boron-doped 3D Porous Carbon Patterns for High Volumetric Energy Density Microsupercapacitors

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Full Lithographic Fabrication of Boron-doped 3D Porous Carbon Patterns for High Volumetric Energy Density Microsupercapacitors

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Abstract:

Carbon electrodes that are thick and maintain a high volumetric energy density are essential for high energy storage microsupercapacitors (MSCs). Here, fabrication of an electrode based on a boron-doped 3D porous carbon pattern (B-3D-PCP) by lithographic processes is demonstrated. The B-3D-PCP is obtained by carbonization and doping of a polymer pattern fabricated by interference lithography. Then, plasma etching is performed on the B-3D-PCP to obtain an interdigitated electrode, and a polymer electrolyte is applied to complete the MSC. The B-3D-PCP shows remarkably high pseudocapacitance after B-doping. This electrode also exhibits no capacitance loss when the electrode width increases, even at very high scan rates, owing to the uniform pores of the 3D-PCP. The solid-state B-3D-PCP MSC with a polymer gel electrolyte shows a capacitance of 7.15 mF/cm^2, with a remarkable capacitance retention of 81%, especially upon a scan rate increase of 10 times at 100 mV. With B-3D-PCP MSCs, a volumetric energy density of 7.1 mWh/cm^3 and a volumetric power density of 66 W/cm^3 could be achieved. Finally, the performance of the MSC is demonstrated