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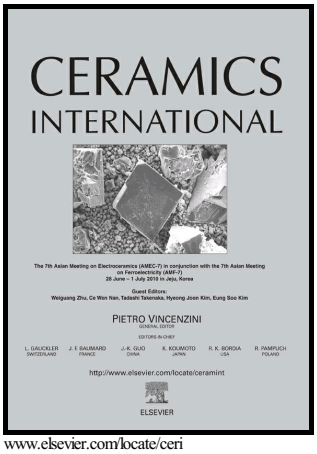

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3D Interconnected Mesoporous Si/SiO_2 Coated with CVD Derived Carbon as an Advanced Anode Material of Li-ion Batteries

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Abstract

3D interconnected mesoporous $C/Si/SiO_2$ composite was synthesized via two facile processes (including magnesiothermic reduction and CVD method) with the SBA-15 as Si source and CH_4 as carbon precursor. The micro/mesopores inside the Si/SiO_2 particles greatly increase the specific surface area, thus shortening the diffusion distance of lithium ions, electron and guaranteeing fast penetration of electrolyte. Raman spectra shows that the CVD derived carbon is partly graphitized, thus largely enhancing its conductivity. Si/SiO_2 coated with two-track carbon (both longitudinal and transverse) and Si/SiO_2 coated with single-track carbon are formed by only changing the experiment order. Such two-track $C/Si/SiO_2$ electrode for lithium-ion battery exhibits 63% higher capacity than the single-track $C/Si/SiO_2$ electrode at high-rate performance, attributed to the fast electrochemical reaction kinetics and electron transport rendered by the conductive 3D interconnected structure. This functional structure can effectively accommodate the volume expansion of Si/SiO_2 and maintain the electrical connection between electrode and active materials, improving the cycling stability of active materials.

Introduction

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