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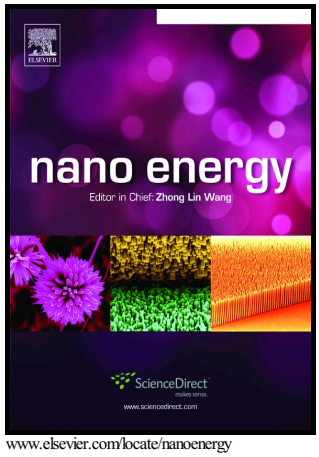

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Oxygen Vacancies: Effective Strategy to Boost Sodium Storage of Amorphous Electrode Materials

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Abstract

Oxygen vacancies (OVs) are reported for the first time as an effective strategy to boost the electrochemical performance for amorphous electrode materials of sodium-ion batteries (SIB). Amorphous SnO_2 is used as a model anode material to demonstrate the significant impact of OVs because it has received much attention in the SIB field. Amorphous SnO_2 ordered arrays are fabricated using the nanoimprinted anodic aluminum oxide (AAO) template and atomic layer deposition and OVs are confined in the material by annealing the arrays in the N_2 atmosphere. The OVs-containing amorphous SnO_2 ordered arrays, used as binder- and conductive additive-free anodes, exhibit high reversible capacity and good cycle life by retaining the capacities of 376 mAh g^{-1} after 100 cycles at 0.05 A g^{-1} and 220 mAh g^{-1} after 800 cycles at 1 A g^{-1}. They also show great rate capability by delivering the capacities of 210 and 200 mAh g^{-1} at 10 and 20 A g^{-1}, respectively. Electrochemical kinetic study reveals that the presence of OVs greatly enhances charge transfer/transport in the amorphous SnO_2, thereby boosts the performance comparing with the OVs-free counterpart. This work highlights the importance of modulating defects in amorphous electrode materials toward promoted sodium storage.