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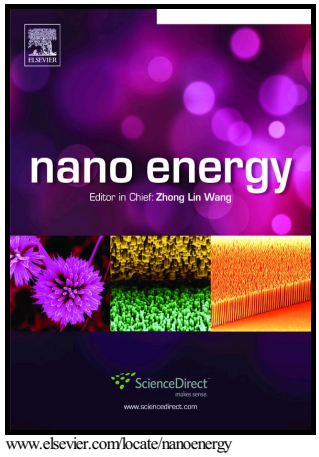

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A New Energy Storage System: Rechargeable Potassium-Selenium Battery

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Abstract

A new reversible and high-performance potassium-selenium (K-Se) battery, using confined selenium/carbonized-polyacrylonitrile (PAN) composite (c-PAN-Se) as cathode and metallic potassium as anode, is reported in this work. The PAN-derived carbon matrix could effectively confine the small Se molecules and provide a sufficient buffer for the volume changes. The reversible formation of small-molecule trigonal Se (Se_1, $P3_121$) phase could essentially inhibit the formation of polyselenides and account for outstanding electrochemical performance. The carbonate-based electrolyte further synergistically diminishes the shuttle effect by inhibiting the formation of polyselenides in the meantime. The as-prepared K-Se battery shows a reversible capacity of 1904 mAh cm^{-3} after 100 cycles at 0.2 C and rate retention of 89% from 0.1 C to 2 C. In addition, the charge-discharge mechanism is also investigated via the combination of in-situ and ex-situ synchrotron X-ray diffraction (XRD), and Raman spectroscopy analysis. The results reveal that the introduction of K^+ ions leads to

[1] These authors contributed equally to this work.