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Printable MnO_2 Based Rechargeable Sodium Batteries

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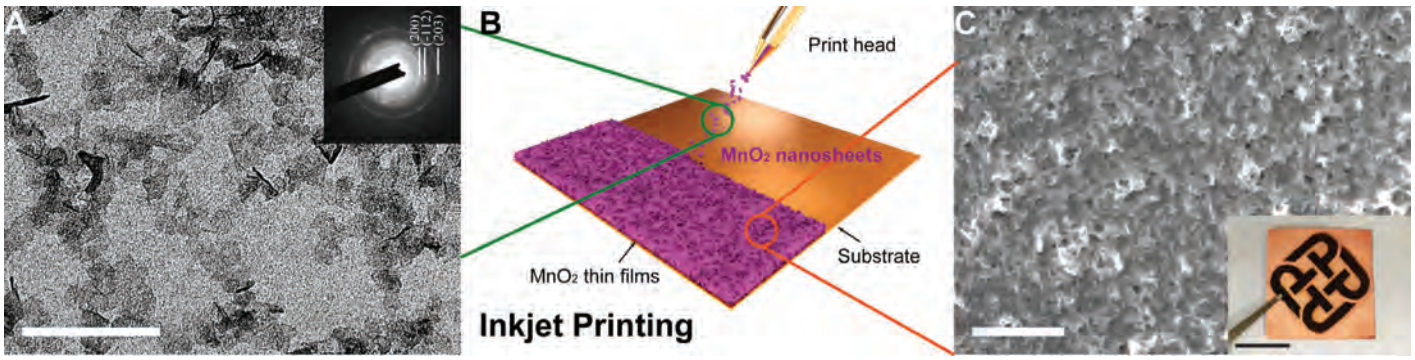
The inkjet-printed MnO_2 electrode can serve as a cathode material for high performance rechargeable sodium batteries. The as-assembled full cell could reach maximum energy and power densities of 147 $Wh \cdot kg^{-1}_{total}$ and 4.6 $kW \cdot kg^{-1}_{total}$ with average working voltage of 2.3V and ca.100% capacity retention after 100 cycles, which could be anticipated for practical energy applications. The MnO_2 based electrode could achieve simultaneously and unprecedentedly a working voltage of 2.5V, maximum energy and power densities of 587 Wh·kg−1cathode and 75 kW·kg−1cathode respectively with a 99.5% capacity retention for 500 cycles at 1 A·g−1. These values are approaching the targeted sodium ion batteries.

The long-neglected kinetically limitation effect is found to be effective in controlling the redox mechanism. The inkjet-printed MnO_2 electrode shows an enhanced redox activity of Mn^{4+}/Mn^{3+} couple, along with a fully suppressed redox activity of Mn^{3+}/Mn^{2+} couple. Owing to the earth-abundant and low cost of sodium (Na) as compared to Li, sodium secondary batteries are envisioned to be a viable alternative to replace the current lithium (Li) based battery industry.

Special Features

- Low-cost due to abundancy of Na
- As a high-performance rechargeable sodium battery



Systematic illustrations of the $K_{0.3}MnO_2$ electrode.

A) Surface view of the TEM image. Scale bar is 100 nm. Inset: the corresponding SAED pattern.
B) Schematic diagram of the inkjet printing process.
C) Surface view of the SEM image. Scale bar is 2 μm. Inset: A patterned electrode.

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