

Enhanced High-Performance, Rechargeable Aqueous Zinc Ion Batteries Using V₂O₅/PEDOT as a Cathode

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The dependence on renewable energy resources has increased tremendously. For industrial and large-scale applications, these energy resources require the use of effective and safe large-scale energy storage devices. Zinc Ion Batteries (ZIBs) are promising candidates for this due to their safety profile and cost advantage. Currently, ZIBs use V₂O₅ as a cathode material, however, V₂O₅ instability negatively affects the battery performance. The purpose of this project is to improve the performance of ZIBs through enhancing the capacity and cycling stability by modifying V₂O₅ cathode structure to make it a suitable cathode for ZIBs. In the experimentation, aqueous ZIBs were designed and constructed with metal oxide conduction polymer (V₂O₅/PEDOT) nanowire cathode. After fabrication, (1M ZnSO₄) aqueous electrolyte, and zinc anode. V₂O₅/PEDOT nanowires were tested by X-ray diffractometer showing large interlayer spacing indicating large capacity. To evaluate the electrochemical performance of V₂O₅/PEDOT nanowires electrode, the CR2016 coin-type cells were assembled with zinc anode. The battery's cycling performance was tested for 200 cycles, showing V₂O₅/PEDOT average capacity of 180 mAh g⁻¹ compared to an average capacity of 90 mAh g⁻¹ with V₂O₅ alone, an enhancement by 100%. Cyclic voltammetry profiles retained their shapes demonstrating predictable charge-discharge patterns and indicating good stability of V₂O₅/PEDOT cathode. This work indicates that V₂O₅/PEDOT cathode can enhance the functionality and performance of ZIBs, making them good candidates for energy storage in large-scale applications.

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