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.