

# Enhanced High-Performance, Rechargeable Aqueous Zinc Ion Batteries Using V<sub>2</sub>O<sub>5</sub>/PEDOT as a Cathode

Alshaikh, Maryam (School: Riyadh School for Boys and Girls)

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 V<sub>2</sub>O<sub>5</sub> as a cathode material, however, V<sub>2</sub>O<sub>5</sub> 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 V<sub>2</sub>O<sub>5</sub> cathode structure to make it a suitable cathode for ZIBs. In the experimentation, aqueous ZIBs were designed and constructed with metal oxide conduction polymer (V<sub>2</sub>O<sub>5</sub>/PEDOT) nanowire cathode. After fabrication, (1M ZnSO<sub>4</sub>) aqueous electrolyte, and zinc anode. V<sub>2</sub>O<sub>5</sub>/PEDOT nanowires were tested by X-ray diffractometer showing large interlayer spacing indicating large capacity. To evaluate the electrochemical performance of V<sub>2</sub>O<sub>5</sub>/PEDOT nanowires electrode, the CR2016 coin-type cells were assembled with zinc anode. The battery's cycling performance was tested for 200 cycles, showing V<sub>2</sub>O<sub>5</sub>/PEDOT average capacity of 180 mAh g<sup>-1</sup> compared to an average capacity of 90 mAh g<sup>-1</sup> with V<sub>2</sub>O<sub>5</sub> alone, an enhancement by 100%. Cyclic voltammetry profiles retained their shapes demonstrating predictable charge-discharge patterns and indicating good stability of V<sub>2</sub>O<sub>5</sub>/PEDOT cathode. This work indicates that V<sub>2</sub>O<sub>5</sub>/PEDOT cathode can enhance the functionality and performance of ZIBs, making them good candidates for energy storage in large-scale applications.