Abstract

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INVESTIGATION OF EFFICIENCY OF REDOX FLOW CELLS FOR LARGE SCALE ENERGY STORAGE APPLICATIONS

Renewable energy storage technologies are required to provide an alternative solution to the problem of balancing power generation and power consumption. In the present study, the performance of a divided, parallel-plate zinc–nickel redox ?ow battery is investigated. The battery consists of sodium hydroxide anodic electrolyte and a cathodic electrolyte made of an equimolar mixture of potassium ferri-cyanide and potassium ferro-cyanide with sodium hydroxide supporting electrolyte. The cell sections are separated by a cationic exchange membrane. The cell performance is studied under different operating conditions during the charge and discharge cycles. The parameters studied include the current density and the electrolyte flow rate. The cell behaviour is evaluated in terms of the energy efficiency, the energy density, the voltage efficiency and the output power. The cell showed an improved performance under high electrolyte velocities. During a 75 minutes charge and discharge times per cycle, the energy efficiency increased with increasing the flow rate and reached approximately 61% at a current efficiency of 100%. On the other hand, the energy efficiency decreased significantly with increasing the charging current density up to approximately 27%. The energy density during discharge ranged from approximately 0.2 to 34 kWh/kg. Compared to traditional cells, the present battery showed significantly higher efficiency and improved performance.