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Fabrication of Eco-friendly Lithium Titanium Phosphate/Lithium Polysulfide/Graphite Rechargeable Batteries

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Abstract

The average global temperature has not changed by more than 1° C over 10,000 years. It is predicted that the global temperature will rise by 3° C by the year 2100, unless action is taken to limit temperature increment to 1.5° C. Since the beginning of the century, the field of lithium-ion battery development has skyrocketed. Li-ion batteries have become the primary electrical energy storage device for portable electronic devices in today's world. This study aims to innovate high-performance, less toxic, low-cost rechargeable lithium-ion batteries with lithium titanium phosphate as anode material, graphite as cathode material and lithium polysulfide as electrolyte under standard laboratory conditions. Cell performance was analyzed by observing the charge and discharge curves. In this research work, the charge-discharge performance was analyzed using LabJack U3-HV with LabJack software. The cell voltage was recorded with time, and using a fixed resistor, current flow was calculated. The cell showed initial voltage of 1.3 V and 10 mA in the first charge curve, the initial voltage was increased to 3.2 V in the second charge curve, and the current has decreased to 5.1 mA. During the discharging process, fast discharging was observed from 2.2 V to 0.2 V, giving current from 3.1 mA to 0.3 mA across 657 Ω. In the charging curve, small voltage plateaus can be seen around 1.5-2.0 V. It was observed that the voltage of charging cycles increases due to the increasement of the cell's internal resistance with time. When increasing the charging voltage across the cell, the current passing through the circuit was decreased by proving Ohm's law and discharge curves demonstrated fast discharge within 60 minutes.

Keywords: Li-ion, Lithium titanium phosphate, Charge curve, Discharge curve