A High-Performance Polyaniline Brick Supercapacitor: A Novel Approach to the Electrical Energy Crisis

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Globally, 775 million people don't have access to electricity. Maximizing the use of renewable energies could enable more people to have access to electricity, however renewable energies are intermittent and need to be stored. Currently lithium ion batteries are being used for energy-storage but they have short cycle life, high cost, long charging times and environmental damage due to mining. This project aims to engineer a low cost, high performance, sustainable electrical storage device by turning bricks into supercapacitor electrodes. To make the supercapacitor, a polyaniline coating was deposited on the brick surface through vapor-phase polymerization by reacting HCL, aniline and Fe2O3 (from the brick). The device was fabricated into a solid-state device by attaching two polyaniline-coated bricks with a gel electrolyte which acted as a separator and a binder. Performance evaluation of the device was carried through analyzing three key parameters; cell capacitance, operating voltage and equivalent series resistance by use of different electrolytes, electrode densities and polymer coating thickness. From the results, the supercapacitor demonstrated a high specific capacitance and voltage window of 3V. Resulting in a very high energy and power density. In comparison to lithium ion batteries, the Polyaniline Brick Supercapacitor is 18 times cheaper and also has a high cycle life. This novel supercapacitor has the potential to enable more people to have access to electrical energy and could also reduce the amount of fossil fuels that are used for electricity generation since renewable energies could be easily and efficiently stored on bricks.

Awards Won:

Ricoh USA, Inc: Ricoh Sustainable Development Award of $10,000