Building a Better Battery: A Prototypical Analysis Utilizing Carbon-Based Ultra-Capacitor Technology

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Batteries are a major part of everyday life. However, most common batteries are slow at recharging and can be dangerous to the environment when improperly disposed of. Our goal was to combine the best qualities of batteries and capacitors into an “Ultra-capacitor” that would capable of charging rapidly and discharging over an extended period of time. Additional engineering goals included making the capacitor environmentally friendly through the use of biodegradable materials and the capability to sustain a 5-volt charge at 1 amp to power a Raspberry Pi computer. A pre-test was conducted to determine the minimum amount of charging time needed for 4 Ni-MH batteries to operate the Raspberry Pi. Dielectrics used were combinations of paper, polyester, and paper towels moistened with salt water layered between graphene and aluminum. 10 iterations and 5 sub-iterations were completed. The plates were charged for varying intervals with 15-volts of direct current. A voltmeter and stopwatch were used to monitor the time it took for the stored energy to drop below 2.0-volts. Our most successful iteration provided a sustained 2.0-volts of energy for more than 20 minutes after a 20 second charge. Future tests will use carbon nanotubes to more rapidly and effectively spread the charge through the graphene, as well as testing other fluids in our dielectric, including oil.