Constructing a Solar Graphene-Based Supercapacitor, Phase II

Hetland, Madison (School: Mitchell High School)

The goal of my project was to improve elements of the supercapacitor constructed in Phase I to achieve a desired voltage, capacitance, resistance, and discharge rate. The procedure from Phase I was used with the following changes: phosphoric acid was replaced by vinegar as an electrolyte which made the capacitor much safer to handle, and greatly reduced corrosion. Aqueous graphene was used instead of graphene powder to ensure that application was only a single layer thick and to increase surface area. The separator, previously composed of shop towel material, was replaced with a single layer of tissue paper to reduce the distance between plates and improve electrical capabilities. Aluminum cans were used in some models as a more readily available metal for the plates. Four supercapacitors were constructed initially in addition to eight supercapacitors constructed for further experimentation. All twelve supercapacitors were functioning and able to maintain an electrical potential, ranging from 0.021-0.976V. Resistance ranged from 0.7O-167.1O and capacitance ranged from 0-20+ μF. The most efficient models held 0.976V, 0.38V, and 0.357V respectively. These models are more environmentally friendly and safer than the supercapacitors constructed in Phase I. The use of pliable metals for plates also expands the application of the capacitors and allows them to be used in smaller devices or molded into objects such as a car door panel. Further research is still warranted to study the ability to charge larger devices and expand application.

Awards Won: