**Developing New Fluoropolymers in Redox Flow Batteries for Storing Renewable Energy**

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The increased adoption of electric vehicles (EV) has added new challenges to our aging national grid system. An innovative approach is to build commercial and residential EV charging stations that utilize wind or solar energy harvested locally—without the need for long-distance power transmission.

Lithium-ion batteries are the device of choice for storing renewable energy at present. However, fire safety and high production costs have become the bottleneck challenges that prevent the storage and usage of intermittent renewable energy. New technologies that are safer and cheaper than lithium-ion batteries are needed to increase the adoption of solar and wind power.

Redox flow batteries comprise a proton-conductive polymeric membrane and two graphite electrodes. Aqueous solutions of metal electrolytes such as iron, titanium/chromium are used for anode and cathode, respectively. Compared with lithium-ion batteries, redox flow batteries have the following competitive advantages:

* They are fire safe. Since water is used in the electrolytes, redox flow batteries have improved fire-safety profiles over lithium-ion batteries.
* They are cheaper. Iron and titanium are less expensive than lithium. In general, an iron-titanium flow battery only costs about 40% of that of lithium-ion batteries.

REU students in his lab will be exposed to a vast array of technologies: organic synthesis, polymer synthesis, battery designs and productions, and battery tests. In addition, students will also learn how to integrate solar panels with in-house battery systems. Dr. Gao’s research work is currently supported by three NSF awards.