Layperson Summary

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The Problem

Due to contamination caused by greenhouse gases emissions resulted from burning of fossil fuel, some countries started to rely on using clean energy sources like solar, wind and tidal as an alternative source of energy because they have less carbon emission and don't have harmful ramifications to the environment. However, there is a lack of reliable technical ways to store the clean energy to guarantee the presence of supply when the sun sets, tides die or wind goes out. If we manufacture materials that have huge surface area to store more energy we can improve the storing capacity of conventional energy charging devices.

The Objectives

Carbon nanotubes (CNTs) have a large surface area compared to bulk materials. We can use them to store more energy and can be used as building materials for those devices to store more charges and therefore reduce the charging time. However, CNTs tend to accumulate together and reduce the surface areas making them less efficient, therefore, we add spacers between them to keep them apart. We have different types of spacers and different sizes of CNTs. We conduct dispersion stability measurements adding spacers to carbon nanotubes, incubating them and then measure remaining concentration of CNTs.

The Expected Outcomes

We aim to conduct full characterization of different molecular spacers with different size and structure CNTs. Structural characterization of shape of CNTs as spacers intercalated between them will be conducted too using TEM, SEM and XRD techniques. Raman spectroscopy measurement will be conducted to both pristine and coordination complexes functionalized SWCNT-thin films formed on filter membranes. Electrochemical characteristics such as capacitance, energy storage, power dissipation, electrochemical impedance spectroscopy will be conducted with the complexes acting as molecular spacers between the SWCNTs in a condensed thin film.