ABSTRACT

Energy-storage materials are in high demand due to the need to transform our traditional energy production methods to more renewable, clean ones such as solar, tidal, and wind resources. These sources require efficient electrochemical-energy storage devices to provide cost-effective alternatives to fossil-fuel combustion. Nanostructured carbon is a promising material for electrochemical-energy storage devices because it has the highest ion-accessible specific surface area known to man. This is advantageous because the amount of energy stored in electrochemical-energy storage materials is proportional to the surface area of the electrode.

To enhance the energy storage in nanostructured carbon, we are studying Earth-abundant metal coordination complexes to act as molecular spacers to prevent complete aggregation of single-walled carbon nanotubes (SWCNTs) as they are made into solid-state films for electrode applications. If we can increase the space between individual tubes, their natural high-specific surface area can be exploited for optimum charge storage and ion-transport. By adsorbing metal-coordination complexes to nanostructured carbon materials through electrostatic and π-π stacking interactions, we can enhance the energy storage of nanostructured carbon films; leading to a decrease in our nation’s dependence on fossil fuel combustion.

In this study, the binding interactions of the complex of interest, +2Zn2 hydrazone, is investigated with different types of SWCNTs, and the viability of this complex as an efficient molecular spacer will be assessed. A hypothesized binding model will be presented based on the size and curvature of the SWCNT, and the stability of this complex will be examined for its ability to be used in electrochemical-energy storage devices. This study will elucidate a better understanding of these binding interactions for future studies.