Project Title

Investigation of conducting polymer/graphene quantum dot composites as new electrode material for supercapacitor

Executive Summary

In recent years, the demand for reliable, efficient and high-powered energy storage devices for vehicles and mobile electronic devices has increased dramatically. Therefore, it is imperative to develop and incorporate new types of materials to fabricate supercapacitors with outstanding energy storage capability. This aim can be realized by combining the two mechanisms of charge storage i.e electric double layer capacitors (EDLC), mainly exhibited by carbonaceous materials (e.g graphene quantum dot) and pseudo-capacitors behavior, which is contributed by redox active materials (conducting polymer). Graphene quantum dots (GQDs), a new member of graphene family is a 0D material that exhibit new phenomena due to quantum confinement and edge effect. GQDs have superior chemical and physical properties associated with both graphene and QDs, such as high specific surface area, good electrical conductivity, high mobility, strong and tunable photoluminescence, slow hot-carrier relaxation and good dispersion in various solvents. These outstanding properties make GQDs suitable as electrode material for supercapacitors. Meanwhile, conducting polymers (CP) are well-studied pseudocapacitive material, has been used as the electrode material for supercapacitors because of the low cost of monomers, its simple synthesis, environmental stability, and the high specific pseudocapacitance. In this work, conducting polymer/ graphene quantum dots (CP/GQD) hybrid materials will be prepared to investigate the energy storage properties. It is expected that new CP/GQD composite materials could show bright promise as electrode materials for supercapacitor due to the synergistic effect of both materials.