**ABSTRACT**

**NANO STRUCTURES FOR SUPER CAPACITOR APPLICATION**

A long time sustainable energy is the only renewable energy. The storage of energy will play a key role in the coming future. Energy is one of the major issue in the society. Batteries have high energy density but the main disadvantage of batteries is chemical reaction in the device, it takes time to store and release the energy and having less no of cycles. Whereas supercapacitors have low energy density but the advantage supercapacitors is takes less time for store and release energy and having more no of cycles. There is a huge demand for high energy and power density electrode, cost-efficient, low-weight, flexible and eco-friendly energy storage device called supercapacitors. For the development of high-performance storage devices novel electrode materials with high energy density and high power density materials are required.

Supercapacitor is an electrochemical capacitor, is a device for storing electrical energy. Supercapacitor has a very high energy density as compared to common capacitor about 100times greater. Supercapacitor is also known as Electric double layer capacitor or Ultra capacitor. The capacitance range of a supercapacitor is from 100F to 5K Farad. Supercapacitors are used in power smart grids, portable electronic devices and electric vehicles etc.. There are 3 types of supercapacitors: 1) Double layer capacitors: stores charge electrostatically, 2) Psuedocapacitors: stores charge electrochemically, 3) Hybrid capacitors: stores charge in both ways electrostatically and electrochemically.

Nano structures offer many advantages as active electrode material in batteries and super capacitor. The nanostructured materials increases the surface area and decreases the diffusion distance that can improves the electrolyte access to as many active material atoms as possible for storing high energy density. TMDS are having the physiochemical properties such as large surface area, high catalytic activity, high conductivity and high chemical stability. TMDS (Transition Metal Dichalcogenides) nanostructured materials are used for electrode materials in supercapacitor application. Based on the literature survey of 2D materials for supercapacitor application it is observed that (VSe2) is synthesized by using hydrothermal method and obtained electrochemical properties such as specific capacitance(680 Fg-1), current density (1 Ag-1), energy density (212 Whkg-1), power density (3.3kwkg-1) and 81% of retention is obtained after 10,000 cycles.

Preliminary studies are done on Graphene oxide material. Graphene oxide is prepared by Modified Hummers method and characterizations are done by XRD and FTIR. The further studies of MoS2 and MoS2/RGO materials will be carried out and characterize them for analyzing the electrochemical studies of super capacitor.

The main objective of this proposal is to design the smaller size nanostuctures and electrode materials of a supercapacitor. Nano structures are used for electrode materials due to its large surface area, excellent electrochemical properties (specific capacitance, high energy, power density and cyclic stability etc.). To synthesis TMDS Nano structures (Transition Metal Dichalcogenides) by hydro thermal method and to characterize them using XRD, UV visible spectroscopy, FTIR, FE-SEM, and TEM. To develop the low cost and efficient based supercapacitor using TMDS and analyzing its electro chemical properties using Cyclic Voltammetry.

**Key words:** Energy Storage Devices, Supercapacitors, TMDS, Graphene oxide.