Electric Double Layer Capacitors (EDLC)

Sadeepa Amarathunga; L.P.J Malshan; D.A.S Amarasinghe*

Department of Material Science and Engineering, University of Moratuwa, Sri Lanka

**Email: shantha2u@uom.lk*

A capacitor is an energy storage device that generates an electric field between electrodes and builds potential that can be channeled through associated circuits. The Electrical Double Layer (EDL) capacitor is a unique capacitor with a remarkably higher capacity. The energy densities of these capacitors can range between 0.5 and 10 Wh/kg. These values are still lower than the energy densities of mainline batteries. However, they fill the gap between the rechargeable batteries and the electrolytic capacitors.

EDL-based supercapacitors were initially used as starter devices for the tank and railroad engines. Nevertheless, they are currently found in appliances and handheld devices. There is a growing market for the product in the transportation industry. Many automotive companies use double-layer capacitors to shield certain electrical engine parts from voltage fluctuations.

Under this study, the dependence of the EDL capacitance on the surface roughness profile of the electrode was investigated using the linear Poisson-Boltzmann theory and the Gouy-Chapman theory. A 1-D model was developed based on first principles to examine the effects of surface roughness. The model developed is important in selecting materials for electrode design.

Keywords: Double layer, Differential capacitance, Surface roughness.