Chapter 2
Historical Background and Present Status of the Supercapacitors

The capacitive performance of the double layer at solid/electrolyte interface is a known phenomenon since 1879, first predicted by Hermann von Helmholtz. But, the practical use of double layered capacitance was first accomplished after the patent on carbon based electrolytic capacitors booked by Becker at the General Electric Corporation (Becker 1957). After Becker, Sohio Corporation, Cleveland, in the year 1969, manufactured the first electric double layer capacitor for the commercial purpose using porous carbon in a non-aqueous solvent comprising tetra alkyl ammonium salt based electrolyte (Boos 1970). In 1978, NEC (a Japanese multinational Information Technology provider) marketed the double layer capacitor technology as "supercapacitor" for the memory back up in computers. Although the product had been placed in the market, but still it was associated with the lower specific energy values. Thereafter, so many efforts have been made to design supercapacitors with higher efficiency. It has been observed that, up to 1990, no such improvement in the material design and technology development for low cost manufacturing of supercapacitors were carried out. Then Conway's group developed the concept of pseudocapacitance by introducing RuO_2 having higher specific capacitance and low series resistance (Conway 1991). Renewed interest toward the development of supercapacitors occurred after recognizing its importance in the hybrid vehicles in the late 90s. These pseudocapacitive materials (especially the transition metal based oxides, polymers etc.) show $\sim$10–100 fold higher energy storage performance in comparison to the EDLCs. This enhanced storage properties are due to the highly reversible redox (faradic) process, which is completely different from that of EDLCs. These types of capacitors involve both the non-faradic (electrical double layer) and faradic (redox) charge storage processes (Zhang et al. 2011). In the present stage, the capacitors available in market constitute both the higher surface area carbon materials (activated carbon) apart from highly redox active RuO_2 (Hu et al. 2006). Because of the high powered supercapacitors, the concept of hybrid energy storage system came into existence that contains supercapacitors integrated either to a fuel cell or a battery.

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