

Contents

1	Introduction	1
2	Instrumentation and Measurement	5
2.1	Different Configurations of Supercapacitor	6
2.1.1	Conventional Configurations	6
2.1.2	Non-conventional Configurations	10
2.2	Key Parameters	18
2.2.1	Specific Capacitance	18
2.2.2	Specific Energy and Specific Power	20
2.2.3	Operating Potential Window	20
2.2.4	Cyclic Stability	21
3	Characterization and Performance Evaluation of Supercapacitor	23
3.1	Double-Layer Formation and Diffusion Process	23
3.2	Surface Adsorption	24
3.3	Pseudocapacitors	25
3.4	Evaluation Techniques	27
3.4.1	Cyclic Voltammetry	28
3.4.2	Step Potential Electrochemical Spectroscopy	29
3.4.3	Constant Current Charge Discharge (CCCD)	30
3.4.4	Electrochemical Impedance Spectroscopy	31
3.4.5	Ideal and Non-ideal Capacitor and the Origin of ESR	33
3.5	Evaluation of Capacitance	35
3.5.1	From the Cyclic Voltammetry Curve	36
3.5.2	From the Constant Current Charge–Discharge Curve	38
3.5.3	From Electrochemical Impedance Spectroscopy	39
3.6	Evaluation of Specific Energy (E_s)	40
3.7	Evaluation of Specific Power (P_s)	41
4	Summary and Focus Point	45
References		47