Supporting Information

The simulation of interface characteristics and charge transfer dynamics for layered electrodes using cascade capacitance in supercapacitors by COMSOL software

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1.Parameters of activated carbon as negative electrode

Property	Variable	Value	Unit	Property group
Electrical conductivity	sigma_iso ; sigmaii = sigma_iso, sigmaij = 0	32.4[S/m]	S/m	Basic
Electrolyte conductivity	sigmal_iso ; sigmalii = sigmal_iso, sigmalij = 0	80[S/m]	S/m	Electrolyte conductivity
Diffusion coefficient	D_iso ; Dii = D_iso, Dij = 0	3.9e-14[m^2/s]	m^2/s	Basic
Density	rho	2260[kg/m^3]	kg/m^3	Basic
Equilibrium potential	Eeq	Eeq_int1(soc)	V	Equilibrium potential
Temperature derivative of equilibrium potential	dEeqdT	0[V/K]	V/K	Equilibrium potential
Reference concentration	cEeqref	def.csmax	mol/m^3	Equilibrium potential
Maximum electrode state of charge	socmax	elpot.Eeq_inv(E_min)	1	Operational electrode state of charge
Minimum electrode state of charge	socmin	elpot.Eeq_inv(E_max)	1	Operational electrode state of charge
Maximum operational potential	E_max	4.2[V]	V	Operational electrode state of charge
Minimum operational potential	E_min	0[V]	V	Operational electrode state of charge
Equilibrium concentration	csEq	def.csmax*elpot.Eeq_inv(V)	mol/m^3	Equilibrium concentration

2.Parameters of KOH solution as electrolyte

Property	Variable	Value	Unit	Property group
Electrolyte conductivity	sigmal_iso ; sigmalii = sigmal_iso, sigmalij = 0	(A*M+B*M^2+C*M*T_K+D*M/T_K+E*M^3+F*M^2*T_K^2)*1[S/cm]	S/m	Electrolyte conductivity
Diffusion coefficient	D_iso ; Dii = D_iso, Dij = 0	3.75e-9[m^2/s]	m^2/s	Basic
Density	rho	(A_rho(T_degC)*M_reg^2+B_rho(T_degC)*M_reg+C_rho(T_degC))*1[kg/m^3]	kg/m^3	Basic
Transport number	transpNum	0.22	1	Species properties
Activity dependence	fcl	2	1	Species properties

3.Parameters of graphene oxide as positive electrode

Property	Variable	Value	Unit	Property group
Electrical conductivity	sigma_iso ; sigmaii = sigma_iso, sigmaij = 0	1000[S/m]	S/m	Basic
Electrolyte conductivity	sigmal_iso ; sigmalii = sigmal_iso, sigmalij = 0	100[S/m]	S/m	Electrolyte conductivity
Young's modulus	E	E_int(c/csmax)	Pa	Basic
Poisson's ratio	nu	nu_int(c/csmax)	1	Basic
Diffusion coefficient	D_iso ; Dii = D_iso, Dij = 0	1.4523e-13*exp(68025.7/8.314*(1/(T_ref/1[K])-1/(T2/1[K])))[m^2/s]	m^2/s	Basic
Thermal conductivity	k_iso ; kii = k_iso, kij = 0	1[W/(m*K)]	W/(m·K)	Basic
Heat capacity at constant pressure	Cp	750[J/(kg*K)]	J/(kg·K)	Basic
Density	rho	2300[kg/m^3]	kg/m^3	Basic
Equilibrium potential	Eeq	Eeq_int1(soc)+dEeqdT_int1(soc)*(T-298[K])	V	Equilibrium potential
Temperature derivative of equilibrium potential	dEeqdT	dEeqdT_int1(soc)	V/K	Equilibrium potential
Reference concentration	cEeqref	def.csmax	mol/m^3	Equilibrium potential
Maximum electrode state of charge	socmax	elpot.Eeq_inv(E_min)	1	Operational electrode state of charge
Minimum electrode state of charge	socmin	elpot.Eeq_inv(E_max)	1	Operational electrode state of charge
Maximum operational potential	E_max	4.2[V]	V	Operational electrode state of charge
Minimum operational potential	E_min	0[V]	V	Operational electrode state of charge
Volumetric strain	dvol	dVOLdSOL(c/def.csmax)	1	Intercalation strain
Equilibrium concentration	csEq	def.csmax*elpot.Eeq_inv(V)	mol/m^3	Equilibrium concentration

4.Parameters of $ZnMn_2O_4$ as positive electrode

	Property	Variable	Value	Unit	Property group
☑	Electrical conductivity	sigma_iso ; sigmaii = sigma_iso, sigmaij = 0	1000[S/m]	S/m	Basic
☑	Electrolyte conductivity	sigmal_iso ; sigmalii = sigmal_iso, sigmalij = 0	100[S/m]	S/m	Electrolyte conductivity
	Young's modulus	E	E_int(c/csmax)	Pa	Basic
	Poisson's ratio	nu	nu_int(c/csmax)	1	Basic
	Diffusion coefficient	D_iso ; Dii = D_iso, Dij = 0	1.4523e-13*exp(68025.7/8.314*(1/(T_ref/1[K])-1/(T2/1[K])))[m^2/s]	m^2/s	Basic
	Thermal conductivity	k_iso ; kii = k_iso, kij = 0	1[W/(m*K)]	W/(m·K)	Basic
	Heat capacity at constant pressure	Cp	750[J/(kg*K)]	J/(kg·K)	Basic
	Density	rho	2300[kg/m^3]	kg/m^3	Basic
	Equilibrium potential	Eeq	Eeq_int1(soc)+dEeqdT_int1(soc)*(T-298[K])	V	Equilibrium potential
	Temperature derivative of equilibrium potential	dEeqdT	dEeqdT_int1(soc)	V/K	Equilibrium potential
	Reference concentration	cEeqref	def.csmax	mol/m^3	Equilibrium potential
	Maximum electrode state of charge	socmax	elpot.Eeq_inv(E_min)	1	Operational electrode state of charge
	Minimum electrode state of charge	socmin	elpot.Eeq_inv(E_max)	1	Operational electrode state of charge
	Maximum operational potential	E_max	4.2[V]	V	Operational electrode state of charge
	Minimum operational potential	E_min	0[V]	V	Operational electrode state of charge
	Volumetric strain	dvol	dVOLdSOL(c/def.csmax)	1	Intercalation strain
	Equilibrium concentration	csEq	def.csmax*elpot.Eeq_inv(V)	mol/m^3	Equilibrium concentration