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Appendix B: Acronyms

3M	Minnesota Mining and Manufacturing Company
AABC	Advanced Automotive Batteries Conference
AAO	Anodized aluminum oxide
AB	Acetylene black
ABA	Anion Binding Agent
ABR	Applied Battery Research for Transportation
AC	Alternating Current
ACS	American Chemical Society
AE	Available energy
AEM	Analytical electron microscopy
AER	All electric range
AE-XRD	Acoustic emission (AE) and X-ray diffraction
AFM	Atomic force microscopy
AGM	Absorbed Glass Mat
ALABC	Advanced Lead Acid Battery Consortium
ALD	Atomic layer deposition
AMR	Annual Merit Review
ANL	Argonne National Laboratory
APS	Advanced Photon Source
ARC	Accelerated rate calorimetry
ARL	Army Research Laboratory
ARPA-E	Advanced Research Projects Agency - Energy
ARRA	American Recovery & Reinvestment Act
ARXS	Angle resolved X-ray spectroscopy
ASI	Area-specific impedance
ASU	Arizona State University
ATD	Advanced Technology Development
ATR	Attenuated total reflection
BAJ	Battery Institute of Japan
BATT	Batteries for Advanced Transportation Technologies
BCF	Binder and carbon free
BDS	Battery Design Studio
BE	Band Excitation
BET	Brunauer, Emmett, and Teller surface area
BEV	Battery electric vehicle
BL	Base-Line
BLE	Baseline electrolyte
BLM	Bureau of Land Management
BMS	Battery management system
BNL	Brookhaven National Laboratory
BOM	Battery ownership model
BSF	Battery scaling factor
BTC	Battery Technology Center
BTM	Battery Thermal Management
CAD	Computer-aided Design
CAE	Computer-aided engineering
CAEBAT	Computer-aided engineering of batteries
CAFE	Corporate Average Fuel Economy (Standards)
CB	Carbon black
CD	Charge depleting
CE	Coulombic efficiency
CED	(U.S.-Canada) Clean Energy Dialogue
CEES	Center for Electrical Energy Storage
CEF	Cathode Energy Factor
CERC	Clean Energy Research Center
CFC	Chemetall Foote Corp.
CFD	Computational Fluid Dynamics
CFF	Cell Fabrication Facility
CID	Current interrupt device
CMC	Sodium Carboxy Methyl Cellulose
CNF	Carbon nano-fibers
CN-SC	Carbon Nanofiber Impregnated Soft Carbon
CNT	Carbon nano-tubes
COGS	Cost of goods sold
COIL-4	The 4th Congress on Ionic Liquids
COP	ConocoPhillips
COTS	Commercial-Off-The-Shelf
CPI	Compact Power Inc.
CPU	Central Processing Unit
CS	Charge-sustaining
CSIRO	Commonwealth Scientific and Industrial Research Organization
CSTR	Continuous-stirred tank reactor
CT	(X-ray) Computed tomography
CTAB	hexadecyltrimethylammonium bromide
CTB	cyclic triol borates
CV	Cyclic voltammogram
CVD	Chemical vapor deposition
CWRU	Case Western Reserve University
CY	Calendar year
DADT	Developmental and applied diagnostic testing
DCR	Direct current resistance
DCS	Distributed control system
DDQ	2,3-Dichloro-5,6-dicyano-1,4-benzoquinon
DEC	Diethyl carbonate
DEMS	differential electrochemical mass spectroscopy
DFT	Density function theory
DMC	Dimethyl carbonate
DME	dimethyl ether
DOD	Depth-of-discharge
DOE	Department of Energy
DOT/NHTSA	Department of Transportation/National Highway Traffic Safety Administration
DPA	Destructive physical analysis
DSC	Differential scanning calorimetry

DST	Dynamic stress test
DTF	Density functional theory
DU	Degree of unsaturation
DVMT	Daily vehicle miles traveled
EA	Environmental assessment
EB	Electron beam
EBSD	electron backscatter diffraction
EC	Ethylene carbonate
ECM	Equivalent Circuit Model
ECS	Electrochemical Society
ECT3D	Electrochemical-Thermal Coupled 3-Dimensional Li-ion Battery Model
EDLC	electrochemical double layer capacitor
EDS	Energy dispersive spectroscopy
EDV	Electric Drive Vehicle
EDX	energy-dispersive x-ray (spectroscopy)
EDXS	energy dispersive X-ray spectroscopy
EELS	Electron energy loss spectroscopy
EERE	(DOE Office of) Energy Efficiency and Renewable Energy
EES	Electrochemical energy storage
EFRC	Energy Frontier Research Center
EIS	Electrochemical Impedance Spectroscopy
EMC	Electron Microscopy Center
EMS	Ethyl methyl sulfone
EOL	End of life
EPA	Environmental Protection agency
EPRI	Electric Power Research Institute
EREV	Extended range electric vehicle
E-REV	Extended range electric vehicle
ESM	Electrochemical strain microscopy
ESMS	Energy Storage Monitoring System
ESS	Energy storage system
EUCAR	European Council for Automotive Research and Development
EV	Electric vehicle
EVI	Electric Vehicle Initiative
EVMS	Earned value management system
EVPC	EV power characterization
EW	electrochemical window
EXAFS	Extended X-ray absorption fine structure
FE	Finite element
FEA	Finite element analysis
FEC	fluoro ethylene carbonate
FESEM	Field-emission scanning electron microscope
FFCC	FutureFuel Chemical Company
FFT	Fast Fourier Transforms
FIB	Focused Ion Beam
FMS	fluoromethyl sulfone
FTBA	perfluorotributylamine
FTIR	Fourier transform infrared
FUDS	Federal Urban Driving Schedule
FVLSM	Finite Volume Linear Superposition Methods
GB	glove box
GC	Gas chromatography
GCMC	carbonate derivative of GC
GC-MS	gas chromatography - mass spectroscopy
GDE	Gas-diffusion-electrodes
GHG	Green house gases
GM	General Motors
GUI	Graphic user interface
HAADF	High Angle Annular Dark Field
HC	high capacity
HCMRTM	high capacity manganese rich cathode materials
HCSD	Harmonic Compensated Synchronous Detection
HE	high energy
HEM	high energy material
HEMM	High energy mechanical milling
HEV	Hybrid electric vehicle
HF	Hydrofluoric acid
HNEI	Hawaii Natural Energy Institute
HOPG	highly-oriented pyrolytic graphite
HP	high power
HPLC	high performance liquid chromatograph
HPPC	Hybrid pulse power characterization
HQ	Hydro-Québec
HREM	High resolution electron micrograph
HRL	heat resistant layer
HR-SEM	high-resolution scanning electron microscopy
HR-TEM	High resolution transmission electron microscopy
HTMI	High temperature melt integrity
HVAC	Heating, Ventilation and Air-conditioning
HVM	High volume manufacturing
HWCVD	Hot wire chemical vaporization deposition
IA	(IEA) Implementing Agreement
IA-HEV	Implementing Agreement - hybrid electric vehicles
IAPG	Interagency Advanced Power Group
IBA	International Battery Materials Association
IBM	International Business Machines
ICA	Incremental capacity analysis
ICACC	Internationational Conference on Advanced Ceramics and Composites
ICL	Irreversible capacity loss
ICP	Inductively coupled plasma
ID	Intensity of the carbon D-band
ID/IG	Ratio of integrated intensities of the D and G peaks
IEA	International Energy Agency

IEEE	Institute of Electrical and Electronics Engineers
ILEET	Ionic Liquids & Electrolytes for Energy Technologies
ILIRP	Integrated Lab-Industry Research Program
IMB	Impedance Measurement Box
INL	Idaho National Laboratory
IP	In-plane (signal)
IPS	Integrated Plasma Simulation
IR	Infra-red
IRAS	in situ external reflection-FTIR
ISC	Internal short circuit
JCI	Johnson Controls, Incorporated
JCS	Johnson Controls - Saft
JPL	Jet Propulsion Laboratory
KIST	Korea Institute of science and Technology
LAHM	loss of active host material
LATP	14 Li2O·9Al2O3·38TiO2·39P2O5 (lithiated glass ceramic)
LBMP	Lithium-bearing mixed polyanion
LBNL	Lawrence Berkeley National Laboratory
LCC	Linear cyclic carbonate
LCMO	lithium cobalt manganese oxide
LCO	Lithium cobalt oxide
LCPM	Levelized cost per mile
LE	Leyden Energy
LEED	Leadership in Energy and Environmental Design
LEES	Lower-energy energy storage (systems)
LEESS	Lower-energy energy storage systems
LFO	Li5FeO4
LFP	Li iron phosphate
LGCMI	LG Chem, Michigan
LGCP	LG Chem Power
LIB	Lithium-ion battery
LIC	lithium ion capacitor
LLNL	Lawrence Livermore National Laboratory
LLTO	(Li,La)TiO3
LMNO	lithium manganese nickel oxide
LMO	Lithium manganese oxide
LNCA	LiNiCoAlO2
LNCM	LiNiCoMnO2
LNMO	LiNi0.5Mn0.5O2
LNP	lithium-nickel-phosphate
LPV	Linear Parameter Variable
LTFOP	Lithium tetrafluoro(oxalate) phosphate
LTI	Linear Time Invariant
LTO	Lithium titanate, Li4Ti5O12
LTOP	Lithium tris(oxalato) phosphate
LUMO	lowest unoccupied molecular orbital
LVO	Lithium vanadium oxide (LiV3O8)
MAS	magic angle spinning
MB	Methyl butyrate
MCMB	Mesocarbon micro beads
MEF	Materials Engineering Facility
MERF	Materials Engineering Research Facility
MIN	methyl isonicotinate
MIT	Massachusetts Institute of Technology
MLD	molecular layer deposition
MNC	Metal-nitrogen- carbon
MNO	Manganese nickel oxide
MP	Methyl propionate
MPPC	Multiple Potential-Pair Continuum
MRS	Materials Research Society
MS	Mass spectroscopy
MSI	mass specific impedance
MSMD	Multi-scale, multi-dimensional
MT	Metric ton
MWNT	Multi-wall carbon nanotubes
MWST	microwave-solvothermal
MYPP	multi-year program plan
NASA	National Aeronautics and Space Administration
NCA	LiNi0.8Co0.15Al0.05O2
NCM	Li1+w[NixCoyMnz]1-wO2
NCSU	North Carolina State University
NEDO	New Energy and Industrial Technology Development Organization (Japan)
NERSC	National Energy Research scientific Computing Center
NETL	National Energy Technology Laboratory
NG	natural graphite
NGP/CNF	nano-graphene platelets/carbon nanofibers
NIU	Northern Illinois University
NMC	LiNi1/3Co1/3Mn1/3O2
NMP	N-methylpyrrolidone
NMR	Nuclear magnetic resonance
NREL	National Renewable Energy Laboratory
NSLS	National Synchrotron Light Source
NSWC	Naval Surface Warfare Center
NSWCCD	Naval Surface Warfare Center, Carderock Division
OAS	Open architecture software
OBD	3-Oxabicyclo[3.1.0]hexane-2,4-dione
OCP	open-circuit potential
OCV	Open circuit voltage
OECD	Organization for Economic Cooperation and Development
OEE	overall equipment effectivenss
OEM	Original equipment manufacturer
OES	optical emission spectrometry
OP	Out-of plane (signal)
ORNL	Oak Ridge National Laboratory
ORR	Oxygen reduction reaction
OSA	Open Software Architecture
PA-HEV	Power assist - hybrid electric vehicle

PAN	Polyacrylonitrile
PAQS	Poly(anthraquinonyl sulfide)
PBE	Perdew Burke Ernzerhof (correlation)
PC	Propylene carbonate
PCFC	pyrolysis combustion flow calorimetry
PCM	polarized continuum model
PD	Path dependence
PEC	Polyethylene carbonate
PEMS	plasma-enhanced magnetron sputtering
PEO	Polyethyleneoxide
PEV	plug-in electric vehicle
PF	polyfluorene
PFO	Poly(9,9-dioctylfluorene)
PFOP	poly[(9,9-dioctylfluorenyl-2,7-diyl)-co-(1,4-phenylene)]
PHEV	Plug-in hybrid electric vehicle
PI	Principal Investigator
PNNL	Pacific Northwest National Laboratory
PPAP	Production Part Approval Process
PPSS	Pacific Power Sources Symposium
PSU	Pennsylvania State University
PTC	positive temperature coefficient (device)
PTFE	poly(tetrafluoroethylene)
PVDF	Poly(vinylidenefluoride)
PXRD	powder X-ray diffractometry
R&D	Research and Development
RDE	rotating-disk electrode
RF	Radio frequency
RFP	Request for proposals
RMS	Root mean square
ROM	Reduced Order Modeling
RT	Room temperature
RUL	remaining useful life
SAD	selected area diffraction
SAE	Society of Automotive Engineers
SAED	Selected area electrode diffraction
SAEDP	selected area electron diffraction pattern
SBIR	Small Business Innovation Research
SBR	Styrene-Butadiene Rubber
SCFM	Standard cubic feet per minute.
SED	stacked electrode design
SEI	Solid electrolyte interphase
SEM	Scanning electron microscopy
SENB	Single Edged Notched Bend
SEO	poly(styrene)-b-poly(ethylene oxide)
SES	poly(styrene-block-ethylene-block-polystyrene)
SET	Source Evaluation Team
SIC	Single ion conducting
SLMP	Stabilized lithium metal powder
SLPB	Superior Lithium Polymer Batteries
SNL	Sandia National Laboratories
SOA	State of the art
SOC	State of charge
SOH	State of health
SORP	Start of Regular Production
SOW	Statement of Work
SPM	Scanning Probe Microscopy
SPPC	Single Potential-Pair Continuum
SRS	Safety Reinforcing Separator
SSRL	Stanford Synchroton Radiation Lightsource
STEM	scanning transmission electron microscopy
STTR	Small Business Technology Transfer Program
SUNY	State University of New York
SWIM	Simulation of RF Wave Interactions with Magnetohydrodynamics
TAC	Technical Advisory Committee
TBACL	tetrabutylammonium chloride
TCNQ	benzoquinone, Tetracyanoquinodimethane
TCS	Traffic Choices Study
TEGDME	tetraethyleneglycoldimethyl
TEM	Transmission electron microscopy
TEY	total electron yield
TFSI	bis(trifluoromethanesulfonyl)imide
TGA	Thermal gravimetric analysis
TM	Transition metal
TMS	Tetramethylene sulfone
TOF-SIMS	time-of-flight – secondary ion mass spectroscopy
TOS	3,9-divinyl-2,4,8,10-tetraoxaspiro[5,5] undecane
TRB	Transportation Research Board
TR-XRD	time-resolved X-ray diffraction
TT	Technical Team
TTF	Thermal Test Facility
TTT	1,3,5-triallyl-[1,3,5]triazinane-2,4,6-trione
TXM	Transmission X-ray Microscopy
UDDS	Urban Dynamometer Driving Schedule
UHMWPE	Ultra High Molecular Weight Polyethylene
UL	Underwriters Laboratory
URI	University of Rhode Island
USABC	United States Advanced Battery Consortium
USDRIVE	Driving Research and Innovation for Vehicle efficiency and Energy sustainability
USGS	United States Geological Survey
UTA	University of Texas, Austin
VACNT	vertically aligned carbon nanotube
VASCNT	vertically aligned silicon carbon nanotube
VASP	Vienna Ab-initio Simulation Package
VC	Vinylene carbonate
VEC	Vinyl ethylene carbonate
VIBE	Virtual Integrated Battery Environment

VRLA	Valve Regulated Lead-Acid
VT, VTP	Vehicle Technology (Program)
WC	Wu-Cohen (correlation)
WECC	Western Electrical Coordinating Council
WPPC	Wound Potential-Pair Continuum
WTW	Well-to-wheels
XAFS	X-ray absorption fine structure
XANE	x-ray absorption near-edge structure (spectra)
XANES	X-ray absorption near edge structure
XAS	X-ray absorption spectroscopy
XES	X-ray emission spectroscopy
XPS	X-ray photoelectron spectroscopy
XRD	X-ray diffraction
XRS	X-ray Raman scattering