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Zhang, Zhengcheng John (ANL)	IV.B.5.1, IV.B.5.2, IV.D.2, IV.E.1.2, V.G.1, V.G.2
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Zhu, Y. (ANL)	IV.C.3
Zhu, Yimin (Nanosys)	III.A.4.3

Appendix B: Acronyms

3M	Minnesota Mining and Manufacturing Company
4M	Man, Machine, Material, and Method
AABC	Advanced Automotive Batteries Conference
AAO	Anodized aluminum oxide
AB	Acetylene black
ABA	Anion Binding Agent
ABR/ABRT	Applied Battery Research for Transportation
AC	Alternating Current
ACS	American Chemical Society
ADP	Ammonium dihydrogen phosphate
AE	Available energy
AEM	Analytical electron microscopy
AER	All electric range
AEV	All-electric vehicle
AE-XRD	Acoustic emission (AE) and X-ray diffraction
AF	Antiferromagnetic
AFM	Atomic force microscopy
AGM	Absorbed Glass Mat
ALABC	Advanced Lead Acid Battery Consortium
ALD	Atomic layer deposition
ALS	Advance light source
AMO	Advanced Manufacturing Office
AMR	Annual Merit Review
ANL	Argonne National Laboratory
AP-ALD	Atmospheric pressure atomic layer deposition
AP-CVD	Atmospheric pressure chemical vapor deposition
APQP	Advanced Product Quality Planning
APS	Advanced Photon Source
APXPS	Ambient-pressure XPS
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
ASCS	Automotive Simulation Centre Stuttgart
ASI	Area-specific impedance
ASR	Area specific resistance
ASU	Arizona State University
ASWC	Automotive Simulatiuon World Congress
ATC	Aluminum tetrachloride
ATD	Advanced Technology Development
ATR	Attenuated total reflection
BAJ	Battery Institute of Japan
BATT	Batteries for Advanced Transportation Technologies
BCF	Binder and carbon free
BCLE	Battery Calendar Life Estimator
BCU	Battery control unit
BDS	Battery Design Studio
BDU	Battery disconnect unit
BE	Band Excitation
BEC	Bussed Electrical Center
BECM	Battery Energy Control Module

BES	Basic Energy Sciences (DOE Office)
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
BOL	Beginning of life
BOM	Battery ownership model
BPSM	Battery Pack Sensor Module
BSF	Battery scaling factor
BTC	Battery Technology Center
BTFMSI	bis(trifluoromethylsulfonyl)imide
BTM	Battery Thermal Management
CAD	Computer-aided Design
CAE	Computer-aided engineering
CAEBAT	Computer-aided engineering of batteries
CAFE	Corporate Average Fuel Economy (Standards)
CALPHAD	CALculation of PHAse Diagram
CB	Carbon black
CCSE	California Center for Sustainable Energy
CD	Charge depleting
CE	Coulombic efficiency
CED	(U.S.-Canada) Clean Energy Dialogue
CEES	Center for Electrical Energy Storage
CEF	Cathode Energy Factor
CEO	Chief Executive Officer
CERC	Clean Energy Research Center
CFC	Chemetall Foote Corp.
CFD	Computational Fluid Dynamics
CFF	Cell Fabrication Facility
CI	Continuous improvement
CID	Current interrupt device
CMC	Sodium Carboxy Methyl Cellulose
CN/CNF	Carbon nanofibers
CN-SC	Carbon Nanofiber Impregnated Soft Carbon
CNT	Carbon nano-tubes
CO	Certificate of Occupancy
COGS	Cost of goods sold
COIL-4	The 4th Congress on Ionic Liquids
COP	ConocoPhillips
COTS	Commercial-Off-The-Shelf
CPI	Compact Power Inc.
CPMD	Carr-Parrinello molecular dynamics theory
CPU	Central Processing Unit
CRADA	Cooperative Research and Development Agreement
CS	Charge-sustaining
CSC	Cell Supervisory Circuit
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
DAQ	Data Acquisition
DC	Direct current
DCR	Direct current resistance
DCS	Distributed control system
DCTA	dicyanotriazolate
DDQ	2,3-Dichloro-5,6-dicyano-1,4-benzoquinon
DEC	Diethyl carbonate
DEMS	differential electrochemical mass spectroscopy
DFOB	difluoro(oxalate)borate
DFT	Density function theory
DK	Dow Kokam
DMA	dimethyl acetamide
DMC	Dimethyl carbonate
DME	dimethyl ether
DMF	dimethylformamide
DMMP	Diethyl Methyl Phosphonate
DMMSA	Dimethylmethanesulfonamide
DNS	direct numerical simulation
DOD	Depth-of-discharge
DOE	Department of Energy
DOT/NHTSA	Department of Transportation/National Highway Traffic Safety Administration
DPA	Destructive physical analysis
DPC	diphosphinato catecholate
DSC	Differential scanning calorimetry
DST	Dynamic stress test
DTA	Differential thermal analysis
DTAB	dodecyltrimethyl-ammonium bromide
DTC	daily thermal cycle
DTF	Density functional theory
DU	Degree of unsaturation
DV	Daily vehicle
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	Energy Efficiency and Renewable Energy (DOE Office)
EES	Electrochemical energy storage
EESTT	Electrical Energy Storage Tech Team
EFRC	Energy Frontier Research Center
EFTEM	energy-filtered transmission electron microscopy
EG/W	Ethylene glycol/water
EIS	Electrochemical Impedance Spectroscopy
EL	Electrode Library
EMC	Electron Microscopy Center
EMS	Ethyl methyl sulfone

EOC	End-of-charge
EOL	End of life
EPA	Environmental Protection agency
EPMA	Electron probe micro-analysis
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
EVS26	The 26th Electric Vehicle Symposium
EW	electrochemical window
EXAFS	Extended X-ray absorption fine structure
FCG	Full concentration gradient
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
FOA	Federal Opportunity Anouncement
FRION	Flame Retardant Ions
FS	Fault signal
FTBA	perfluorotributylamine
FTIR	Fourier Transform InfraRed spectroscopy
FUDS	Federal Urban Driving Schedule
FVLSM	Finite Volume Linear Superposition Methods
FY	Fiscal year
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
GITT	Galvanostatic intermittent titration technique
GM	General Motors
GUI	Graphic user interface
HAADF	High Angle Annular Dark Field
HC	high capacity
HCA	high capacity anode
HCC	high capacity cathode
HCMRTM	high capacity manganese rich cathode materials
HCSD	Harmonic Compensated Synchronous Detection
HE	high energy
HEBM	high energy ball milling
HEM	high energy material
HEMM	High energy mechanical milling
HEV	Hybrid electric vehicle
HEXRD	high energy X-ray diffraction
HF	Hydrofluoric acid

HFP	hexafluorophosphate
HIL	Hardware-in-the-loop
HIP	hot isostatically pressing
HNEI	Hawaii Natural Energy Institute
HOMO	highest occupied molecular orbital
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-SXRD	High resolution Silicon X-tal Reflective Display,
HR-TEM	High resolution transmission electron microscopy
HR-XPS	High resolution X-ray photoelectron spectroscopy
HS	High speed
HS-CAN	High Speed Controller Area Network
HT	hydrothermal
HTMI	High temperature melt integrity
HV	High voltage
HVAC	Heating, Ventilation and Air-conditioning
HVBS	high voltage battery system
HVC	high voltage cathode
HVM	High volume manufacturing
HVTB	High Voltage Traction Battery
HW	Hot wire
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
IC	Inner composition
ICA	Incremental capacity analysis
ICACC	Internationational Conference on Advanced Ceramics and Composites
ICE	Internal combustion engine
ICL	Irreversible capacity loss
ICP	Inductively coupled plasma
ICP-AES	Inductively coupled plasma atomic emission spectroscopy
ID	Intensity of the carbon D-band
ID/IG	Ratio of integrated intensities of the D and G peaks
IEA	International Energy Agency
IEA-HEV	International Energy agency - hybrid electric vehicle
IEEE	Institute of Electrical and Electronics Engineers
IEP	Isoelectric point
ILEET	Ionic Liquids & Electrolytes for Energy Technologies
ILIRP	Integrated Lab-Industry Research Program
IMB	Impedance Measurement Box
IMLB	International Meeting on lithium Batteries
INL	Idaho National Laboratory
IP	In-plane (signal)
IPS	Integrated Plasma Simulation
IR	Infra-red
IRAS	in situ external reflection-FTIR
IRCL	Irreversible Capacity Loss
ISC	Internal short circuit

JCI	Johnson Controls, Incorporated
JCS	Johnson Controls - Saft
JPL	Jet Propulsion Laboratory
JV	Joint venture
KB	Ketjenblack
KIST	Korea Institute of science and Technology
LAHM	loss of active host material
LAM	Loss of active material
LATP	14 Li2O•9Al2O3•38TiO2•39P2O5 (lithiated glass ceramic)
LBMP	Lithium-bearing mixed polyanion
LBNL	Lawrence Berkeley National Laboratory
LCC	Linear cyclic carbonate
LCFP	Lithium cobalt iron phosphate
LCMO	lithium cobalt manganese oxide
LCO	Lithium cobalt oxide
LCP	Lithium cobalt phosphate
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
LGCPI	LG Chem Power Inc.
L-HPPC	Low-current Hybrid Pulse Power Characterization
LIB	Lithium-ion battery
LIBS	Laser induced breakdown spectroscopy
LIC	lithium ion capacitor
LLI	Loss of lithium inventory
LLNL	Lawrence Livermore National Laboratory
LLTO	(Li,La)TiO3
LMCT	Ligand to metal charge transfer
LMNO	lithium manganese nickel oxide
LMO	Lithium manganese oxide
LMR-NCM	Lithium manganese rich nickel cobalt manganese oxide
LNCA	LiNiCoAlO2
LNCM	LiNiCoMnO2
LNMO	LiNi0.5Mn0.5O2
LNP	lithium-nickel-phosphate
LPV	Linear Parameter Variable
LS	Low spin
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
MCC	Motor control center
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
MSR	Mass specific resistance
MT	Metric ton
MW/MWCNT	Multi-wall carbon nanotubes
MW-HT	Microwave-assisted hydrothermal
MWNT	Multi-wall carbon nanotubes
MWST	microwave-solvothermal
MW-ST	microwave-assisted solvothermal
MYPP	multi-year program plan
NASA	National Aeronautics and Space Administration
NASA-JSC	NASA, Johnson Space Center
NCA	LiNi0.8Co0.15Al0.05O2
NCM	Li1+w[NixCoyMnz]1-wO2
NCSU	North Carolina State University
NDA	Non-Disclosure Agreement
NDE	Non-destructive evaluation
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
NIST	National Institute of Standards and Technology
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
NTGK	Newman-Tiedemann-Gu-Kim (model)
OAS	Open architecture software
OBD	3-Oxabicyclo[3.1.0]hexane-2,4-dione
OC	Outer composition
OCP	open-circuit potential
OCV	Open circuit voltage
OECD	Organization for Economic Cooperation and Development
OEE	overall equipment effectivenss
OEM	Original equipment manufacturer
OER	Oxygen evolution reaction
OES	optical emission spectrometry
OHD	3-Oxabicyclo[3.1.0]hexane-2,4-dione
OP	Out-of plane (signal)
ORNL	Oak Ridge National Laboratory
ORR	Oxygen reduction reaction
OSA	Open Software Architecture
OVT	(DOE) Office of Vehicle Technologies
PA-HEV	Power assist - hybrid electric vehicle
PAHEV, PA-HEV	Power assist - hybrid electric vehicle

PAN	Polyacrylonitrile
PAQS	Poly(anthraquinonyl sulfide)
PBE	Perdew Burke Ernzerhof (correlation)
PBM	Planetary ball milling
PC	Propylene carbonate
PCB	Printed circuit board
PCFC	pyrolysis combustion flow calorimetry
PCM	polarized continuum model
PD	Path dependence
PEC	Polyethylene carbonate
PEI	Polyethyleneimine
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
PLD	Pulsed laser deposition
PMP	Project Management Plan
PNNL	Pacific Northwest National Laboratory
PPAP	Production Part Approval Process
PPSS	Pacific Power Sources Symposium
PQ	Project Quarter
PS	Polystyrene
PSP	Particle Stability Parameter
PS-PE-PS	polystyrene-b-polyethylene-b-polystyrene
PSU	Pennsylvania State University
PTC	positive temperature coefficient (device)
PTF	Post-Test Facility
PTFE	poly(tetrafluoroethylene)
PVDF	Poly(vinylidenefluoride)
PXRD	powder X-ray diffractometry
R&D	Research and Development
RC	Resistance-Capacitor
RDE	rotating-disk electrode
RF	Radio frequency
RFP	Request for proposals
RMS	Root mean square
ROM	Reduced Order Modeling
RSOXS	Resonant soft X-ray scattering
RT	Room temperature
RTO	Regenerative Thermal Oxidizer
RUL	remaining useful life
SAD	selected area diffraction
SAE	Society of Automotive Engineers
SAED	Selected area electrode diffraction
SAEDP	selected area electron diffraction pattern
SAXS	Small Angle X-ray Scattering
SBG	Si/B4C/graphite
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
SIMS	Secondary ion mass spectrometry
SLMP	Stabilized lithium metal powder
SLPB	Superior Lithium Polymer Batteries
SNL	Sandia National Laboratories
SNS	Spallation Neutron Source
SOA	State of the art
SOC	State of charge
SOH	State of health
SOP	Start of production
SORP	Start of Regular Production
SOW	Statement of Work
SPI	Schedule performance index
SPM	Scanning Probe Microscopy
SPPC	Single Potential-Pair Continuum
SQUID	Superconducting Quantum Interference Device
SRP	Solvent Recovery Process
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
SUV	Sport utility vehicle
SWIM	Simulation of RF Wave Interactions with Magnetohydrodynamics
TAC	Technical Advisory Committee
TAP	Technology Assessment Program
TBACL	tetrabutylammonium chloride
TCNQ	benzoquinone, Tetracyanoquinodimethane
TCS	Traffic Choices Study
TDI	4,5-dicyano-2-(trifluoromethyl)imidazolide
TEGDME	tetraethyleneglycoldimethyl
TEM	Transmission electron microscopy
TEY	total electron yield
TFSI	bis(trifluoromethanesulfonyl)imide
TFY	Total fluorescence yield
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
TPP	Tri(2-furyl)phosphine
TPYT	2,4,6-Tris(2-propen-1-yloxy)-1,3,5-triazene
TRB	Transportation Research Board
TR-XRD	time-resolved X-ray diffraction
TSE	Twin-screw extruder
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
VMS	Variational multi-scale simulation
VMT	Vehicle miles traveled
VRLA	Valve Regulated Lead-Acid
VSATT	Vehicle Systems Analysis Technical Team
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
XCT	X-ray Computed Tomography
XES	X-ray emission spectroscopy
XPS	X-ray photoelectron spectroscopy
XRD	X-ray diffraction
XRF	X-ray fluorescence spectroscopy
XRS	X-ray Raman scattering
ZFC	Zero field cooling