

## 10. Acronyms

|                  |  |
|------------------|--|
| 1D               | One dimensional                                    |
| 3D               | Three dimensional                                  |
| A/C              | Air-Conditioning                                   |
| ABR              | Advanced Battery Research                          |
| AC               | Alternating current                                |
| ACE              | Advanced combustion engine                         |
| ACEC             | Advanced Combustion and Emissions Control          |
| ADP              | Advanced drying process                            |
| AEC              | Automotive Electronics Council                     |
| AEC              | Advanced Engine Combustion                         |
| AFCI             | Advanced Fuel Cycle Initiative                     |
| AFDC             | Alternative Fuels Data Center                      |
| AFR              | Air to fuel ratio                                  |
| AFV              | Alternative fuel vehicle                           |
| Ah               | Ampere-hour  |
| AKI              | Anti-knock index                                   |
| Al               | Aluminum   |
| ALD              | Atomic Layer Deposition                            |
| AlF <sub>3</sub> | Aluminum fluoride                                  |
| AMR              | Annual Merit Review                                |
| ANL              | Argonne National Laboratory                        |
| APEEM            | Advanced Power Electronics and Electrical Machines |
| API              | Application programming interface                  |
| APM              | Analog power module                                |
| APRF             | Advanced Powertrain Research Facility (ANL)        |
| APS              | Advanced photon source                             |
| APU              | Auxiliary Power Unit                               |

|        |  |
|--------|--|
| ARK    | Abuse Reaction Kinetics                            |
| ARL    | Army Research Lab                                  |
| ARPA-E | Advanced Research Projects Agency - Energy         |
| ARRA   | American Recovery and Reinvestment Act             |
| ASTM   | American Society for Testing and Materials         |
| ATF    | Automatic transmission fluid                       |
| ATR    | Attenuated Total Reflectance                       |
| Au     | Gold   |
| AVFL   | Advanced Vehicle/Fuel/Lubricants                   |
| AVTA   | Advanced Vehicle Testing Activity                  |
| AVTE   | Advanced Vehicle Testing & Evaluation              |
| BATT   | Batteries for Advanced Transportation Technologies |
| BES    | Office of Basic Energy Sciences                    |
| BEV    | Battery electric vehicle                           |
| BIM    | Bonded interface material                          |
| BIW    | Body in white                                      |
| BL     | Boundary lubrication                               |
| BMEP   | Brake Mean Effective Pressure                      |
| BMR    | Battery Materials Research                         |
| BMS    | Battery Management System                          |
| BNL    | Brookhaven National Laboratory                     |
| BP     | Budget period                                      |
| BP     | Bandpass   |
| BSFC   | Brake-specific fuel consumption                    |
| BSG    | Belt-Driven Starter-Generator                      |
| BTE    | Brake thermal efficiency                           |
| C      | Carbon   |
| C      | Centigrade   |

|                 |   |
|-----------------|---|
| Ca              | Calcium   |
| CAD             | Computer-aided design   |
| CAE             | Computer-aided engineering  |
| CAEBAT          | Computer-aided engineering of batteries   |
| CAFE            | Corporate average fuel economy  |
| CAMP            | Cell Analysis, Modeling, and Prototyping  |
| CARB            | California Air Resources Board  |
| CCC             | Co-precipitated CuO <sub>x</sub> , CoO <sub>y</sub> , and CeO <sub>2</sub> catalyst |
| CCV             | Cycle-to-cycle variability  |
| CDC             | Conventional diesel combustion  |
| CEC             | California Energy Commission  |
| CEI             | Cathode electrolyte interphase  |
| CF              | Carbon fiber  |
| CFC             | Carbon fiber composite  |
| CFD             | Computational fluid dynamics  |
| CG              | Concentration gradient  |
| CGI             | Compacted graphite iron   |
| CH <sub>4</sub> | Methane   |
| CHA             | Chabazite   |
| CI              | Compression ignition  |
| CIC             | Communications, information, and communication                                      |
| CLEERS          | Cross-Cut Lean Exhaust Emission Reduction Simulation                                |
| CMC             | Carboxymethyl Cellulose   |
| CN              | Cetane number   |
| CNG             | Compressed natural gas  |
| CNT             | Carbon Nanotubes  |
| CNT             | Carbon Nanotubes  |
| CO              | Carbon Monoxide   |

|                 |   |
|-----------------|---|
| Co              | Cobalt  |
| CO              | Carbon Monoxide                                 |
| CO <sub>2</sub> | Carbon dioxide                                  |
| COV             | Coefficient of variance                         |
| CPES            | Center for Power Electronics Systems            |
| CPT             | Capacitive power transfer                       |
| CPU             | Central processing unit                         |
| Cr              | Chromium  |
| CR              | Compression ratio                               |
| CRADA           | Cooperative Research and Development Agreement  |
| CRAFT           | Complete Reduction to Amplitude Frequency Table |
| CRC             | Coordinating Research Council                   |
| CRF             | Combustion Research Facility                    |
| CSC             | Cold Start Concept                              |
| CSTR            | Continually stirred tank reactor                |
| CT              | Computed tomography                             |
| CTE             | Coefficient of thermal expansion                |
| Cu              | Copper  |
| CVT             | Continuously variable transmission              |
| CY              | Calendar year                                   |
| CZ              | Ceria-zirconia                                  |
| dBA             | Decibel   |
| DBC             | Direct bonded copper                            |
| DC              | Direct current                                  |
| DCN             | Derived cetane number                           |
| DCR             | Direct current resistance                       |
| DCT             | Dual-clutch transmission                        |
| D-EGR           | Dedicated-Exhaust Gas Recirculation             |

|      |   |
|------|---|
| DFT  | Density functional theory                 |
| DI   | Direct Injection                          |
| DISI | Direct Injection Spark Ignited            |
| DMF  | 2,5-Dimethylfuran                         |
| DNS  | Direct numerical simulation               |
| DOC  | Diesel oxidation catalyst                 |
| DoD  | Depth of discharge                        |
| DOD  | Department of Defense                     |
| DOE  | Department of Energy                      |
| DOT  | Department of Transportation              |
| DOT  | Department of Transportation              |
| DPF  | Diesel particulate filter                 |
| DPP  | Dynamic particle-packing                  |
| DRG  | Diagnosis-related group                   |
| DSC  | Differential Scanning Calorimetry         |
| DSNY | City of New York Department of Sanitation |
| DTBP | Di-t-butyl peroxide                       |
| DTNA | Daimler Trucks North America              |
| Dy   | Dysprosium                                |
| E0   | 0% ethanol blend with gasoline            |
| E10  | 10% ethanol blend with gasoline           |
| E20  | 20% ethanol blend with gasoline           |
| E30  | 30% ethanol blend with gasoline           |
| E85  | 85% ethanol blend with gasoline           |
| EA   | Ethylene acrylic                          |
| Ea   | Activation energy                         |
| EATS | Exhaust after-treatment system            |
| EC   | Ethylene Carbonate                        |

|      |  |
|------|--|
| ECN  | Engine Collaboration Network                     |
| ECS  | Emission control system                          |
| ECT  | Electrochemical-Thermal Coupling                 |
| ECU  | Engine control unit                              |
| EDLC | Electrochemical double-layer capacitors          |
| EDM  | Electrode domain model                           |
| EDS  | Energy Dispersive X-ray Spectroscopy             |
| EDT  | Electric Drive Technologies                      |
| EDV  | Electric Drive Vehicle                           |
| EELS | Electron Energy Loss Spectroscopy                |
| EERE | Office of Energy Efficiency and Renewable Energy |
| EETT | Electrical and Electronics Technical Team        |
| EG   | Ethylene glycol                                  |
| EGR  | Exhaust gas recirculation                        |
| EHN  | 2-ethylhexyl nitrate                             |
| EHR  | Exhaust heat recovery                            |
| EIA  | Energy Information Administration                |
| EIS  | Electrochemical Impedance Spectroscopy           |
| EM   | Electric motor                                   |
| EMC  | Electromagnetic compatibility                    |
| EMI  | Electromagnetic interference                     |
| EOL  | End-of-life                                      |
| EPA  | Environmental Protection Agency                  |
| EPR  | Electron Paramagnetic Resonance                  |
| EPRI | Electric Power Research Institute                |
| EPTO | Electric power takeoff                           |
| ERC  | Engine Research Center                           |
| EREV | Extended range electric vehicle                  |

|       |  |
|-------|--|
| ESIF  | Energy Systems Integration Facility      |
| ESL   | Equivalent series inductance             |
| ESR   | Equivalent series resistance             |
| ESS   | Energy Storage Systems                   |
| EU    | European Union                           |
| EV    | Electric vehicle                         |
| eVMT  | Electric vehicle miles traveled          |
| EVSE  | Electric vehicle supply equipment        |
| EXAFS | Extended X-ray Absorption Fine Structure |
| F     | Fluorine                                 |
| FA    | Field Aging                              |
| FACE  | Fuels for Advanced Combustion Engines    |
| FAME  | Fatty acid methyl ester                  |
| FBCC  | Front bumper and crush can               |
| FC    | Fluorocarbon                             |
| FC    | Fuel cell                                |
| FCA   | Fiat Chrysler Automobiles                |
| FCEV  | Fuel cell electric vehicle               |
| FCG   | Full concentration gradient              |
| Fe    | Iron                                     |
| FE    | Fuel economy                             |
| FEA   | Finite element analysis                  |
| FEC   | Fluorinated ethylene carbonate           |
| FEG   | Fuel Economy Guide                       |
| FEM   | Finite element modeling                  |
| FET   | Field-effect transistor                  |
| FFV   | Flex-fuel vehicles                       |
| FGM   | Flamelet generated manifold              |

|                |   |
|----------------|---|
| FHWA           | Federal Highway Administration  |
| FMEP           | Friction mean effective pressure                                      |
| FOA            | Funding Opportunity Announcement                                      |
| FSP            | Friction Stir Processing  |
| FST            | Filter sensing technologies   |
| FTE            | Full-time equivalent  |
| FTIR           | Fourier Transform Infrared Spectroscopy                               |
| FTMPG          | Freight ton-miles per gallon  |
| FTP            | Federal Test Procedure  |
| FY             | Fiscal year   |
| g              | gram  |
| GaN            | Gallium Nitride   |
| GATE           | Graduate Automotive Technology Education                              |
| GCI            | Gasoline compression ignition   |
| GDCI           | Gasoline Direct Compression Engine                                    |
| GDI            | Gasoline direct injection   |
| GE             | General Electric  |
| GFR            | Glomerular filtration rate  |
| GHG            | Greenhouse gas  |
| GM             | General Motors  |
| GPF            | Gasoline Particulate Filter   |
| GPU            | Graphics Processing Unit  |
| GREET          | Greenhouse Gas, Regulated Emissions, and Energy Use in Transportation |
| GSA            | Global sensitivity analysis   |
| GSF            | Generic Speed Form  |
| GTDI           | Gasoline Turbocharged Direct Injection                                |
| GTR            | Global Technical Regulation   |
| H <sub>2</sub> | Hydrogen  |



|                  |  |
|------------------|--|
| H <sub>2</sub> O | Water  |
| HA               | Hydrothermal assisted                            |
| HC               | Hydrocarbon                                      |
| HCCI             | Homogeneous Charge Compression Ignition          |
| HcJ              | Thermal coefficient of coercive force            |
| HCl              | Hydrogen chloride                                |
| HCMR             | High capacity manganese rich                     |
| HD               | Heavy-Duty                                       |
| HECC             | High efficiency clean combustion                 |
| HEDGE            | High-Efficiency Dilute Gasoline Engine           |
| HEV              | Hybrid electric vehicle                          |
| HF               | Hydrofluoric acid                                |
| HHDDT            | Heavy heavy-duty diesel truck                    |
| HHV              | Hydraulic hybrid vehicle                         |
| HIL              | Hardware in the Loop                             |
| HOMO             | Highest occupied molecular orbital               |
| HOV              | Heat of vaporization                             |
| HOV              | High-occupancy vehicle                           |
| HPC              | High Performance Computing                       |
| HR               | High-resolution                                  |
| HRSXRD           | High-resolution Synchrotron X-ray Diffraction    |
| HRTEM            | high-resolution transmission electron microscopy |
| HV               | High voltage                                     |
| HVAC             | Heating, Ventilating and Air Conditioning        |
| HVE              | High-voltage fluorinated electrolyte             |
| HVM              | High-volume Manufacturing                        |
| ICE              | Internal combustion engine                       |
| ICL              | Initial capacity loss                            |

|         |   |
|---------|---|
| ICME    | Integrated Computational Material Engineering                 |
| ICNIRP  | International Commission on Non-Ionizing Radiation Protection |
| ICT     | Institute of Chemical Technology                              |
| IDT     | Ignition delay time   |
| IE      | Ion exchange  |
| IEC     | International Electrochemical Commission                      |
| IEEE    | Institute of Electrical and Electronics Engineers             |
| IGBT    | Insulated-gate bipolar transistors                            |
| IMEP    | Indicated mean effective pressure                             |
| IMSA    | International Motor Sports Association                        |
| INL     | Idaho National Laboratory                                     |
| IP      | Intellectual property   |
| IPM     | Integrated permanent magnet                                   |
| IQT     | Ignition quality tester                                       |
| IR      | Infrared  |
| ISFC    | Indicated Specific Fuel Consumption                           |
| ISMG    | integrated starter motor generators                           |
| ISO     | International Organization for Standardization                |
| ITE     | Indicated Thermal Efficiency                                  |
| ITS JPO | Intelligent Transportation Systems Joint Program Office       |
| JCESR   | Joint Center for Energy Storage Research                      |
| JCI     | Johnson Controls, Inc.  |
| K       | Potassium   |
| kg      | Kilogram  |
| kHz     | Kilohertz   |
| Kn      | Knudsen Number  |
| kV      | Kilovolt  |
| kW      | Kilowatt  |

|                           |                                       |
|---------------------------|---------------------------------------|
| kWh                       | Kilowatt Hour                         |
| L                         | Liter                                 |
| La                        | lanthanum                             |
| LANL                      | Los Alamos National Laboratory        |
| LBNL                      | Lawrence Berkeley National Laboratory |
| LCA                       | Life cycle assessment                 |
| LCA                       | Life-cycle analysis                   |
| LCCF                      | Low-Cost Carbon Fibers                |
| LCFS                      | Low-carbon fuel standard              |
| LCO                       | Lithium Cobalt Oxide                  |
| LD                        | Light-duty                            |
| LDA                       | Laser doppler anemometry              |
| LDV                       | light-duty vehicle                    |
| LEESS                     | Lower-Energy Energy Storage System    |
| LES                       | Large Eddy Simulation                 |
| LEV                       | Low Emission Vehicle                  |
| LFO                       | Lithium Iron Oxide                    |
| LFP                       | Lithium Iron Phosphate                |
| Li                        | Lithium                               |
| $\text{Li}_2\text{MnO}_3$ | Lithiated transition metal oxides     |
| $\text{Li}_2\text{ZrO}_3$ | Lithium zirconate                     |
| LIB                       | Lithium Ion Battery                   |
| $\text{LiBF}_4$           | Lithium tetrafluoroborate             |
| LiBOB                     | Lithium bis(oxalate)borate            |
| LIBS                      | Laser-induced breakdown spectroscopy  |
| LIC                       | Lithium ion capacitor                 |
| LIF                       | Laser-induced fluorescence            |
| Li-ion                    | Lithium Ion                           |

|                   |   |
|-------------------|---|
| LiPF <sub>6</sub> | Effective electrolyte salt for lithium-ion battery    |
| LiPON             | Lithium Phosphorous Oxynitride                        |
| LiTFSI            | Lithium Bis(Trifluoromethanesulfonyl)Imide            |
| LL                | Layered lithium                                       |
| LLC               | Layered-layered spinel composite                      |
| LLFC              | Lean lifted-flame combustion                          |
| LLNL              | Lawrence Livermore National Laboratory                |
| LMNO              | Ni-substituted manganese spinel oxides                |
| LMO               | Lithium Manganese Oxide                               |
| LMR               | Lithium Manganese Rich                                |
| LNT               | Lean NO <sub>x</sub> Trap                             |
| LOGIT             | Logistic regression                                   |
| LOMO              | Lowest occupied molecular orbital                     |
| LPL               | Low-pressure loop                                     |
| LT                | Low temperature                                       |
| LTC               | Low-temperature combustion                            |
| LTGC              | Low Temperature Gasoline Combustion                   |
| MA3T              | Market Acceptance of Advanced Automotive Technologies |
| MBC               | Model based controls                                  |
| MBSE              | Model-based system engineering                        |
| MCE               | Multi-cylinder engine                                 |
| MD                | Machine direction                                     |
| MD                | Medium-Duty   |
| MECA              | Manufacturers of Emission Controls Association        |
| MECT              | Mechanical electrochemical-thermal                    |
| Mg                | Magnesium   |
| MGOe              | Megagauss-oersteds                                    |
| MIT               | Massachusetts Institute of Technology                 |

|                   |   |
|-------------------|---|
| mJ                | Millijoule  |
| MLCC              | Multilayer ceramic capacitor                      |
| MLD               | Molecular layer deposition                        |
| MMFC              | Multi-mode flow controller                        |
| MMV               | Multi-material vehicle                            |
| Mn                | Manganese   |
| Mo <sub>2</sub> C | Molybdenum Carbide                                |
| MON               | Motor octane number                               |
| MOSFET            | Metal–oxide–semiconductor field-effect transistor |
| MOSS              | Multi beam optical stress sensor                  |
| MOU               | Memorandum of Understanding                       |
| MPa               | Megapascal  |
| MPG               | Miles per gallon                                  |
| MPGe              | Miles per gallon-electric                         |
| MPG <sub>e</sub>  | Miles per gallon gasoline equivalent              |
| MPI               | Message passing interface                         |
| MS                | Mass spectroscopy                                 |
| ms                | Milliseconds                                      |
| MSU               | Michigan State University                         |
| MTM               | Mini-traction machine                             |
| MTU               | Michigan Technological University                 |
| MY                | Model year  |
| N <sub>2</sub>    | Nitrogen  |
| N <sub>2</sub> O  | Nitrous Oxide                                     |
| NA                | Naturally aspirated                               |
| Na                | Sodium  |
| NaOH              | Sodium hydroxide                                  |
| NBB               | National Biodiesel Board                          |

|                 |   |
|-----------------|---|
| NCA             | Battery cathode material (nickel cobalt aluminum oxide) |
| NCM             | Nickel Cobalt Manganese                                 |
| ND              | Neutron diffraction                                     |
| Nd              | Neodymium   |
| NDE             | Non-Destructive Evaluation                              |
| NERSC           | National Energy Research Scientific Computing Center    |
| NF              | Nanofiber   |
| NG              | Natural gas   |
| NGO             | Non-governmental organization                           |
| NGV             | Natural gas vehicle                                     |
| NH <sub>3</sub> | Ammonia   |
| NHTSA           | National Highway Traffic Safety Administration          |
| NHV             | Net heating value                                       |
| Ni              | Nickel  |
| NIST            | National Institute of Standards and Technology          |
| NIST            | National Institute of Standards and Technology          |
| NMC             | Nickel Manganese Cobalt oxide                           |
| NMOG            | Non-methane organic gases                               |
| NMP             | N-Methylpyrrolidone                                     |
| NMR             | Nuclear magnetic resonance                              |
| NO              | Nitric Oxide  |
| NO <sub>2</sub> | Nitrogen Dioxide  |
| NO <sub>x</sub> | Oxides of Nitrogen                                      |
| NRE             | Non-rare earth  |
| NREL            | National Renewable Energy Laboratory                    |
| NSC             | NO <sub>x</sub> Storage Catalyst                        |
| NSF             | National Science Foundation                             |
| NSR             | NO <sub>x</sub> Storage Reduction                       |

|                |  |
|----------------|--|
| NVH            | Noise, vibration, and harshness  |
| NVO            | Negative Valve Overlap   |
| NYBEST         | New York Battery and Energy Storage Technology Consortium                  |
| O <sub>2</sub> | Oxygen   |
| OAS            | Open architecture standard   |
| OBC            | On-board charger   |
| OBD            | On-board diagnostics   |
| OCV            | Open-circuit voltage   |
| Oe             | Oersteds   |
| OE             | Department of Energy Office of Electricity Delivery and Energy Reliability |
| OEM            | Original Equipment Manufacturer  |
| OH             | Hydroxide  |
| ORC            | Organic Rankine Cycle  |
| ORNL           | Oak Ridge National Laboratory  |
| OSC            | Oxygen storage capacity  |
| OSU            | Ohio State University  |
| P              | Phosphorous  |
| Pa             | Pascal   |
| PAH            | Polycyclic aromatic hydrocarbon  |
| PAN            | Polyacrylonitrile  |
| PBA            | Planar bond-all  |
| PCA            | Principal component analysis   |
| PCB            | Printed circuit boards   |
| PCCI           | Premixed Charge Compression Ignition                                       |
| PCM            | Phase change material  |
| PCP            | Peak cylinder pressures  |
| PDT            | Pulse discharge technique  |
| PE             | Power electronics  |

|      |                                       |
|------|---------------------------------------|
| PEI  | Polyetherimide                        |
| PEO  | Polyethylene oxide                    |
| PEV  | Plug-in electric vehicle              |
| PFI  | Port Fuel Injection                   |
| PFS  | Partial fuel stratification           |
| PGM  | Platinum group metal                  |
| PHEV | Plug-in hybrid electric vehicle       |
| PI   | Principal investigator                |
| PIV  | Particle image velocimetry            |
| PLZT | Lead lanthanum zirconate titanate     |
| PM   | Permanent magnet                      |
| PM   | Particulate matter                    |
| PMI  | Particulate matter index              |
| PML  | Polymer-multi-layer                   |
| PMSM | Permanent magnet synchronous motor    |
| PN   | Particulate number                    |
| PNA  | Passive NO <sub>x</sub> adsorber      |
| PNNL | Pacific Northwest National Laboratory |
| POD  | Proper orthogonal decomposition       |
| PPC  | Partially Premixed Combustion         |
| ppm  | Part per million                      |
| PPy  | Polypyrrole                           |
| Pr   | Praseodymium                          |
| Pt   | Platinum                              |
| PTC  | Positive temperature coefficient      |
| PVDF | Polyvinylidene difluoride             |
| PWM  | Pulse width modulation                |
| Q&A  | Questions and answers                 |



|        |   |
|--------|---|
| QA     | Quality assurance                           |
| QC     | Quality control                             |
| R&D    | Research and Development                    |
| RANS   | Reynolds-Averaged Navier Stokes             |
| RCCI   | Reactivity controlled compression ignition  |
| RCM    | Rapid compression machines                  |
| RE     | Rare earth                                  |
| RF     | Radio frequency                             |
| RFPI   | Request for proposal information            |
| RFS    | Renewable Fuel Standard                     |
| Rh     | Rhodium                                     |
| ROI    | Return on investment                        |
| RON    | Research octane number                      |
| RPM    | Rotations per minute                        |
| RR     | Rolling resistance                          |
| RS     | Rapidly solidified                          |
| RT     | Room temperature                            |
| Ru     | Ruthenium                                   |
| S      | Sulfur                                      |
| SACI   | Spark assisted compression ignition         |
| SAE    | Society of Automotive Engineers             |
| Sb     | Antimony                                    |
| SCAQMD | South Coast Air Quality Management District |
| SCR    | Selective catalytic reduction               |
| SCRf   | Selective catalytic reduction on filters    |
| SDO    | Standards definition organizations          |
| SEI    | Solid Electrolyte Interface                 |
| SEM    | Scanning Electron Microscope                |

|                  |  |
|------------------|--|
| SFG              | Sum frequency generation   |
| SGIP             | Smart Grid Interoperability Panel  |
| SHA              | State Highway Agency   |
| Si               | Silicon  |
| SI               | Spark ignition   |
| SiC              | Silicon carbon   |
| SIDI             | Spark-ignition direct-injection  |
| SIMS             | Secondary ion mass spectrometry  |
| SiO <sub>2</sub> | Silicon dioxide  |
| SLMP             | Stabilized lithium metal powder  |
| SMD              | Sauter Mean Diameter   |
| Sn               | Tin  |
| SNL              | Sandia National Laboratory   |
| SOA              | State of the art   |
| SOC              | State of Charge  |
| SOF              | Solvent extractable fraction   |
| SS               | Steady state   |
| STEM             | Scanning transmission electron microscopy                                  |
| SULEV            | Super Low-Emission Vehicle   |
| SUV              | Sport utility vehicle  |
| SXAS             | Soft X-ray absorption spectroscopy   |
| TARDEC           | U.S. Army Tank and Automotive Research, Development and Engineering Center |
| TCR              | Thermochemical recuperation  |
| TD               | Transverse direction   |
| TDC              | Top dead center  |
| TE               | Thermoelectric   |
| TEG              | Thermoelectric Generator   |
| TEM              | Transmission Electron Microscope   |

|            |   |
|------------|---|
| Ti         | Titanium  |
| TIM        | Thermal interface materials   |
| TJI        | Turbulent jet ignition  |
| TM         | Transition Metal  |
| TMA        | Tri Methyl Aluminum   |
| TOF        | Time of flight  |
| TOU        | Time of use   |
| TPGME      | tri-propylene glycol methyl ether   |
| TRD        | Transmission radiation detector   |
| TR-XRD     | Time-resolved X-ray diffraction   |
| TWC        | Three-Way Catalyst  |
| TXM        | Transmission x-ray microscope   |
| U.S. DRIVE | U.S. Driving Research and Innovation for Vehicle Efficiency and Energy sustainability |
| UC         | University of California  |
| UConn      | University of Connecticut   |
| UHC        | Unburned hydrocarbons   |
| UM         | University of Michigan  |
| UPS        | United Parcel Service   |
| UQ         | Uncertainty quantification  |
| USABC      | US Advanced Battery Consortium  |
| USAMP      | United States Automotive Materials Partnership  |
| USCAR      | U.S. Council for Automotive Research  |
| UTS        | Ultimate tensile strength   |
| UW         | UW  |
| UWM        | UW-Milwaukee  |
| V          | Vanadium  |
| V          | Volt  |
| V2G        | Vehicle-to-Grid   |

|       |   |
|-------|---|
| V2I   | Vehicle-to-Infrastructure                       |
| V2V   | Vehicle-to-Vehicle                              |
| V2X   | Vehicle-to-Grid, Infrastructure, and/or Vehicle |
| VAN   | Vehicle Analysis                                |
| VC    | Vinylene Carbonate                              |
| VCR   | Variable compression ratio                      |
| VCT   | Variable camshaft timing                        |
| VIBE  | Virtual Integrated Battery Environment          |
| VM    | Viscosity modifier                              |
| VMT   | Vehicle miles traveled                          |
| VOC   | Volatile organic compounds                      |
| VSS   | Vehicle & System Simulation                     |
| VSST  | Vehicle systems safety technology               |
| VTMS  | Vehicle thermal management system               |
| VTO   | Vehicle Technologies Office                     |
| VUV   | Vacuum ultraviolet                              |
| VVA   | Variable Valve Actuation                        |
| WBG   | Wide bandgap                                    |
| WFSM  | Wound field synchronous motor                   |
| Wh    | Watt hour                                       |
| WHR   | Waste Heat Recovery                             |
| WPT   | Wireless Power Transfer                         |
| WSU   | Washington State University                     |
| XAFS  | X-ray absorption fine structure                 |
| XANES | X-ray Absorption Near Edge Spectroscopy         |
| XAS   | X-ray Absorption Spectroscopy                   |
| xEV   | Electric vehicle (all configurations)           |
| XPS   | X-ray Photoelectron Spectroscopy                |

|      |                                     |
|------|-------------------------------------|
| XRD  | X-ray Diffraction (Crystallography) |
| XRF  | X-ray Fluorescence                  |
| ZECT | Zero Emission Cargo Transport       |
| ZEV  | Zero emission vehicle               |
| Zn   | Zinc                                |
| Zr   | Zirconium                           |
| ZT   | Thermoelectric Figure of Merit      |

(This page intentionally left blank)