XI. Acronyms and Abbreviations

°C Degrees Celsius
°F Degrees Fahrenheit
1-D, 1D One-dimensional
2-D, 2D Two-dimensional
3-D, 3D Three-dimensional
1Q First quarter of the fiscal year
2Q Second quarter of the fiscal year
3Q Third quarter of the fiscal year
4Q Fourth quarter of the fiscal year
6F Hexafluorinated (biphenol A) sulfonated poly(arylene ether sulfone)
6FCN-x HexaFluoro bisphenol A based disulfonated polybenzonitirle (H+ form) (x denotes degree of sulfonation)
6F-x HexaFluoro bisphenol A based disulfonated polySulfone (H+ form) (x denotes degree of sulfonation)
ΔH Enthalpy; heat of reaction
ΔH°f Standard heat of formation
ΔP Pressure drop, pressure change
λ Lambda, hydration number
µA Micro ampere(s)
µA/cm² Micro ampere(s) per square centimeter
µg Microgram(s)
µm Micrometer(s); micron(s)
µM Micromolar
µmol Micromole(s)
µΩ-cm² Micro-ohm(s) - square centimeter
µV Micro volt(s)
Ω Ohm(s)
Ω-cm² Ohm-square centimeter
ρa Apparent density of activated carbon
ρadH₂ Adsorbate hydrogen density in micropores
A Ampere, amp
Å Angstrom
AB Ammonia borane
ABI Automated Ball Indentation, Agent-Based Investment
ABM Agent-based modeling
ABMS Agent-based modeling and simulation
ABPBI Poly(2,5-benzimidazole)
A/cm² Amps per square centimeter
AC Alternating current
AC Activated carbon
ACR Autothermal cyclic reforming
ACS American Chemical Society
AC-Transit Alameda Contra Costa Transit
AE Alkaline earth
AEET Alternative Energy Engineering Technician
AEO Annual Energy Outlook
AES Auger electron spectroscopy
AFM Atomic force microscopy
Ag Silver
AgCl Silver chloride
AHCHG Ad Hoc Committee for Hydrogen Gas
AIBN Azobisisobutyl nitrile
AIChe American Institute of Chemical Engineers
AirCred Air Quality Credits calculation software tool developed by ANL
AK Alkali
Al Aluminum
AlCl₃ Aluminum chloride
ALD Atomic layer deposition
AlH₃ Aluminum hydride; alane
Al₂O₃ Aluminum oxide
Alt-G1 Alternative dendron generation-one
AM Air mass
AM 1.5 Air Mass 1.5 solar illumination
ANL Argonne National Laboratory
ANS American Nuclear Society
ANSI American National Standards Institute
ANT Albany Nano Tech, SUNY
APCI, APCi Air Products and Chemicals, Inc.
APR Aqueous-phase reforming
APS Arizona Public Service
APS American Physical Society
APU Auxiliary power unit
AR Adsorption reactor
a.u., A.U. Arbitrary Units
Ar Argon
ARC Accelerated reaction calorimetry
As Arsenic
a-Si Amorphous silicon
a-SiGe Amorphous silicon germanium
ASM American Society of Metals
ASCM Automotive Systems Cost Model
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>ASMSS</td>
<td>Anode side membrane support structure</td>
</tr>
<tr>
<td>ASPEN</td>
<td>Modeling software</td>
</tr>
<tr>
<td>ASR</td>
<td>Area-specific resistance</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>AT</td>
<td>Ammonia triborane</td>
</tr>
<tr>
<td>at%, at.%</td>
<td>Atomic percent</td>
</tr>
<tr>
<td>ATG</td>
<td>Adenine, Thymine, Guanine, the 3 base combinations that indicate the first translatable amino acid on the DNA molecule</td>
</tr>
<tr>
<td>atm</td>
<td>Atmosphere</td>
</tr>
<tr>
<td>ATP</td>
<td>Adenosine triphosphate</td>
</tr>
<tr>
<td>ATR</td>
<td>Autothermal reformer; autothermal reforming</td>
</tr>
<tr>
<td>ATS</td>
<td>Adsorption test stand</td>
</tr>
<tr>
<td>Au</td>
<td>Gold</td>
</tr>
<tr>
<td>AuS</td>
<td>Gold sulfide</td>
</tr>
<tr>
<td>AuSnO$_x$</td>
<td>gold supported on hydrous tin oxide</td>
</tr>
<tr>
<td>AuTiO$_x$</td>
<td>gold supported on titanium oxide</td>
</tr>
<tr>
<td>Avg</td>
<td>Average</td>
</tr>
<tr>
<td>AVR</td>
<td>Ford’s Agent-Based Hydrogen Vehicle Owner and Fuel Retailer model</td>
</tr>
<tr>
<td>B</td>
<td>Boron</td>
</tr>
<tr>
<td>Ba</td>
<td>Barium</td>
</tr>
<tr>
<td>barg</td>
<td>Bar gauge</td>
</tr>
<tr>
<td>bcc</td>
<td>Body-centered cubic</td>
</tr>
<tr>
<td>Be</td>
<td>Beryllium</td>
</tr>
<tr>
<td>BEOS</td>
<td>Bender equation of state</td>
</tr>
<tr>
<td>BES</td>
<td>Basic Energy Sciences office within the DOE Office of Science</td>
</tr>
<tr>
<td>BESR</td>
<td>Bio-ethanol steam reforming</td>
</tr>
<tr>
<td>BET</td>
<td>Brunner-Emmett-Teller surface area analysis method</td>
</tr>
<tr>
<td>B-H</td>
<td>Boron/hydrogen bond</td>
</tr>
<tr>
<td>BH$_4$</td>
<td>Borohydride</td>
</tr>
<tr>
<td>Bi</td>
<td>Bismuth</td>
</tr>
<tr>
<td>BM</td>
<td>Ball-milled</td>
</tr>
<tr>
<td>BMPFFP</td>
<td>1-butyl-1-methyl-pyrrolidinium tris(pentafluoroethyl)trifluorophosphate</td>
</tr>
<tr>
<td>BN</td>
<td>Boron nitride</td>
</tr>
<tr>
<td>BNH$_x$</td>
<td>Dehydrogenated ammonia-borane</td>
</tr>
<tr>
<td>BNL</td>
<td>Brookhaven National Laboratory</td>
</tr>
<tr>
<td>B-O</td>
<td>Boron/oxygen bond</td>
</tr>
<tr>
<td>B$_2$O$_3$</td>
<td>Boron oxide; diboron trioxide</td>
</tr>
<tr>
<td>BOM</td>
<td>Bill of materials</td>
</tr>
<tr>
<td>BOP, BoP</td>
<td>Balance-of-plant</td>
</tr>
<tr>
<td>$^{11}$B-NMR</td>
<td>Boron 11 Nuclear Magnetic Resonance</td>
</tr>
<tr>
<td>BP</td>
<td>British Petroleum</td>
</tr>
<tr>
<td>BPM</td>
<td>Brushless permanent magnet</td>
</tr>
<tr>
<td>BPS</td>
<td>Ballard Power Systems</td>
</tr>
<tr>
<td>BPSH</td>
<td>Biphenyl sulfone H form; aromatic polysulfone</td>
</tr>
<tr>
<td>BPSH-x</td>
<td>BiPhenyl based disulfonated polySulfone (H+ form) (x denotes degree of sulfonation)</td>
</tr>
<tr>
<td>BPSH-30</td>
<td>Biphenyl sulfone H form, 30% molar fraction of disulfonic acid unit (30% level of sulfonation)</td>
</tr>
<tr>
<td>BPV</td>
<td>Boiler and Pressure Vessel</td>
</tr>
<tr>
<td>Br</td>
<td>Bromine</td>
</tr>
<tr>
<td>Br$_2$</td>
<td>Diatomic bromine</td>
</tr>
<tr>
<td>BSE</td>
<td>Back scattered electron</td>
</tr>
<tr>
<td>BSS</td>
<td>Bootstrap start</td>
</tr>
<tr>
<td>BTU, Btu</td>
<td>British thermal unit(s)</td>
</tr>
<tr>
<td>C</td>
<td>Carbon</td>
</tr>
<tr>
<td>C</td>
<td>Coulomb</td>
</tr>
<tr>
<td>Ca</td>
<td>Calcium</td>
</tr>
<tr>
<td>CA</td>
<td>Carbon aerogel</td>
</tr>
<tr>
<td>CaBr$_2$</td>
<td>Calcium bromide</td>
</tr>
<tr>
<td>CaCO$_3$</td>
<td>Calcium carbonate</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer-aided design</td>
</tr>
<tr>
<td>CAE</td>
<td>Computer-aided engineering</td>
</tr>
<tr>
<td>CAER</td>
<td>Center for Applied Energy Research</td>
</tr>
<tr>
<td>CaFCP</td>
<td>California Fuel Cell Partnership</td>
</tr>
<tr>
<td>Calphad</td>
<td>Calculation of phase diagrams</td>
</tr>
<tr>
<td>CAN</td>
<td>Controller area network</td>
</tr>
<tr>
<td>CaO</td>
<td>Calcium oxide</td>
</tr>
<tr>
<td>CaS</td>
<td>Calcium sulfide</td>
</tr>
<tr>
<td>CbHS</td>
<td>Carbon-based Hydrogen Storage</td>
</tr>
<tr>
<td>CBS</td>
<td>Casa Bonita strain</td>
</tr>
<tr>
<td>cc</td>
<td>Cubic centimeter(s)</td>
</tr>
<tr>
<td>CCD</td>
<td>Charge-coupled device</td>
</tr>
<tr>
<td>cc/g cat/hr</td>
<td>Cubic centimeter(s) per gram catalyst per hour</td>
</tr>
<tr>
<td>CCHSS</td>
<td>Complex Compound Hydrogen Storage System</td>
</tr>
<tr>
<td>CCM</td>
<td>Catalyst-coated membrane</td>
</tr>
<tr>
<td>CCT</td>
<td>Continuous cooling transformation</td>
</tr>
<tr>
<td>Cd</td>
<td>Cadmium</td>
</tr>
<tr>
<td>CDC</td>
<td>Carbide-derived carbon</td>
</tr>
<tr>
<td>CDO</td>
<td>Code development organization</td>
</tr>
<tr>
<td>Ce</td>
<td>Cerium</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>CEA</td>
<td>Commissariat a Energie Atomique</td>
</tr>
<tr>
<td>CEC</td>
<td>California Energy Commission</td>
</tr>
<tr>
<td>CeO&lt;sub&gt;2&lt;/sub&gt;</td>
<td>Ceric oxide</td>
</tr>
<tr>
<td>Cermet</td>
<td>Combination of ceramic and metal</td>
</tr>
<tr>
<td>CERT</td>
<td>Committee on Energy Research and Technology</td>
</tr>
<tr>
<td>CFC</td>
<td>Chlorofluorocarbon</td>
</tr>
<tr>
<td>CFD</td>
<td>Computational fluid dynamics</td>
</tr>
<tr>
<td>cfm</td>
<td>Cubic feet per minute</td>
</tr>
<tr>
<td>CGA</td>
<td>Compressed Gas Association</td>
</tr>
<tr>
<td>CGO</td>
<td>Cerium gadolinium oxide</td>
</tr>
<tr>
<td>CH&lt;sub&gt;2&lt;/sub&gt;</td>
<td>Compressed hydrogen gas</td>
</tr>
<tr>
<td>CH&lt;sub&gt;4&lt;/sub&gt;</td>
<td>Methane</td>
</tr>
<tr>
<td>C&lt;sub&gt;2&lt;/sub&gt;H&lt;sub&gt;4&lt;/sub&gt;</td>
<td>Ethylene</td>
</tr>
<tr>
<td>C&lt;sub&gt;2&lt;/sub&gt;H&lt;sub&gt;6&lt;/sub&gt;</td>
<td>Ethane</td>
</tr>
<tr>
<td>CHARGEH2</td>
<td>GTI hydrogen cylinder filling model</td>
</tr>
<tr>
<td>CHARM</td>
<td>Cost-effective High-efficiency Advanced Reforming Module</td>
</tr>
<tr>
<td>CS</td>
<td>Chemically stabilized</td>
</tr>
<tr>
<td>Chl</td>
<td>Chlorophyll</td>
</tr>
<tr>
<td>CHP</td>
<td>Combined heat and power</td>
</tr>
<tr>
<td>CIS</td>
<td>CulnSe (alloy of copper, indium, and selenium)</td>
</tr>
<tr>
<td>Cl</td>
<td>Chlorine</td>
</tr>
<tr>
<td>Cl-Bcat</td>
<td>Catechol chloroborane where boron is bound to catecholate dianion and chlorine (B-Cl)</td>
</tr>
<tr>
<td>CLV</td>
<td>City of Las Vegas</td>
</tr>
<tr>
<td>cm</td>
<td>Centimeter</td>
</tr>
<tr>
<td>cm&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Square centimeter</td>
</tr>
<tr>
<td>CMU</td>
<td>Carnegie Mellon University</td>
</tr>
<tr>
<td>CNG</td>
<td>Compressed natural gas</td>
</tr>
<tr>
<td>CNT</td>
<td>Carbon nanotube</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon monoxide</td>
</tr>
<tr>
<td>Co</td>
<td>Cobalt</td>
</tr>
<tr>
<td>CO&lt;sub&gt;2&lt;/sub&gt;</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>CoE</td>
<td>Center of Excellence</td>
</tr>
<tr>
<td>COF&lt;sub&gt;2&lt;/sub&gt;</td>
<td>Carbonyl fluoride</td>
</tr>
<tr>
<td>COPV</td>
<td>Composite Overwrapped Pressure Vessel</td>
</tr>
<tr>
<td>COS</td>
<td>Carbon oxysulfide; carbonyl sulfide</td>
</tr>
<tr>
<td>CoTPP</td>
<td>Cobalt tetraphenyl porphyrin</td>
</tr>
<tr>
<td>COx</td>
<td>Oxides of carbon</td>
</tr>
<tr>
<td>cp</td>
<td>Commercial purity</td>
</tr>
<tr>
<td>c.p.s.</td>
<td>Counts per second</td>
</tr>
<tr>
<td>CPSS</td>
<td>Combinatorial powder synthesis system</td>
</tr>
<tr>
<td>Cr</td>
<td>Chromium</td>
</tr>
<tr>
<td>CRBJT</td>
<td>Combined reverse-Brayton Joule-Thompson</td>
</tr>
<tr>
<td>CS</td>
<td>Chemically stable</td>
</tr>
<tr>
<td>Cs</td>
<td>Cesium</td>
</tr>
<tr>
<td>CSA</td>
<td>Canadian Standards Association</td>
</tr>
<tr>
<td>CSA</td>
<td>Cell stack assembly</td>
</tr>
<tr>
<td>CSMP</td>
<td>Cabot Superior MicroPowders</td>
</tr>
<tr>
<td>CSR</td>
<td>Catalytic steam reforming</td>
</tr>
<tr>
<td>CSTE</td>
<td>Coefficient of thermal expansion</td>
</tr>
<tr>
<td>CTO</td>
<td>Conductive transparent oxide</td>
</tr>
<tr>
<td>Cu</td>
<td>Copper</td>
</tr>
<tr>
<td>CU</td>
<td>University of Colorado</td>
</tr>
<tr>
<td>CV</td>
<td>Cyclic voltammetry; cyclic voltammogram</td>
</tr>
<tr>
<td>CuO</td>
<td>Cupric oxide, copper(II) oxide</td>
</tr>
<tr>
<td>Cu&lt;sub&gt;2&lt;/sub&gt;O</td>
<td>Cuprous oxide</td>
</tr>
<tr>
<td>CUTE</td>
<td>Clean Urban Transport for Europe</td>
</tr>
<tr>
<td>CY</td>
<td>Calendar year</td>
</tr>
<tr>
<td>CZO</td>
<td>Ceria-zirconia</td>
</tr>
<tr>
<td>d</td>
<td>Day(s)</td>
</tr>
<tr>
<td>d&lt;sub&gt;br&lt;/sub&gt;</td>
<td>Dubini-Radushkevich average micropore diameter</td>
</tr>
<tr>
<td>DADB</td>
<td>Diammoniate of diborane</td>
</tr>
<tr>
<td>dB(A)</td>
<td>Decibel(s) A scale</td>
</tr>
<tr>
<td>DC</td>
<td>Direct current</td>
</tr>
<tr>
<td>DCEC</td>
<td>Delaware County Electric Cooperative, Inc.</td>
</tr>
<tr>
<td>DCHX</td>
<td>Direct contact heat exchanger</td>
</tr>
<tr>
<td>DDOT</td>
<td>District of Columbia Dept. of Transportation</td>
</tr>
<tr>
<td>DDT</td>
<td>Deflagration-to-detonation transition</td>
</tr>
<tr>
<td>DFC</td>
<td>Direct fuel cell</td>
</tr>
<tr>
<td>DFM</td>
<td>Design for manufacture</td>
</tr>
<tr>
<td>DFMA&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Design for Manufacture and Assembly</td>
</tr>
<tr>
<td>DFSS</td>
<td>Design for six sigma</td>
</tr>
<tr>
<td>DFT</td>
<td>Density functional theory</td>
</tr>
<tr>
<td>DH-RH</td>
<td>Dehydrogenation and rehydrogenation</td>
</tr>
<tr>
<td>DI</td>
<td>Deionized</td>
</tr>
<tr>
<td>dL/g</td>
<td>Deciliters per gram</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>DMA</td>
<td>Dynamic mechanical analysis</td>
</tr>
<tr>
<td>DMAc</td>
<td>Dimethyl acetamide</td>
</tr>
<tr>
<td>DME</td>
<td>Dimethyl ether</td>
</tr>
<tr>
<td>DMFC</td>
<td>Direct methanol fuel cell</td>
</tr>
<tr>
<td>DNA</td>
<td>Deoxyribonucleic acid</td>
</tr>
<tr>
<td>DOD</td>
<td>Depth of discharge</td>
</tr>
<tr>
<td>DOD</td>
<td>U.S. Department of Defense</td>
</tr>
<tr>
<td>DOE</td>
<td>U.S. Department of Energy</td>
</tr>
<tr>
<td>DOT</td>
<td>U.S. Department of Transportation</td>
</tr>
<tr>
<td>DPAU</td>
<td>Differential pressure adsorption unit</td>
</tr>
<tr>
<td>DRIFFTs</td>
<td>Diffuse reflectance infrared Fourier transform spectroscopy</td>
</tr>
<tr>
<td>DS</td>
<td>Dielectric spectroscopy</td>
</tr>
<tr>
<td>DSC</td>
<td>Differential scanning calorimetry</td>
</tr>
<tr>
<td>DSM™</td>
<td>Dimensionally stable membrane (trademark of Giner Electrochemical Systems, LLC)</td>
</tr>
<tr>
<td>DTA</td>
<td>Differential thermal analysis</td>
</tr>
<tr>
<td>DV</td>
<td>Diesel vehicle</td>
</tr>
<tr>
<td>e⁻</td>
<td>Electron</td>
</tr>
<tr>
<td>E</td>
<td>Potential</td>
</tr>
<tr>
<td>Ea</td>
<td>Activation energy</td>
</tr>
<tr>
<td>EAN</td>
<td>Ethylammonium nitrate</td>
</tr>
<tr>
<td>EASA</td>
<td>Electrochemically active surface area</td>
</tr>
<tr>
<td>EC</td>
<td>European Community; electro-chemical</td>
</tr>
<tr>
<td>ECA</td>
<td>Electrochemical area</td>
</tr>
<tr>
<td>ECE</td>
<td>Economic Commission for Europe</td>
</tr>
<tr>
<td>ECS</td>
<td>Electrochemical Society</td>
</tr>
<tr>
<td>ECSA</td>
<td>Electrochemical surface area</td>
</tr>
<tr>
<td>ECTOS</td>
<td>Ecological City Transport System (Iceland)</td>
</tr>
<tr>
<td>EDAX</td>
<td>Manufacturer of energy dispersive X-ray hardware and software</td>
</tr>
<tr>
<td>EDM</td>
<td>Electrical discharge machining</td>
</tr>
<tr>
<td>EDS</td>
<td>Energy dispersive x-ray spectroscopy; Energy dispersive spectrum</td>
</tr>
<tr>
<td>EDX</td>
<td>Energy dispersive x-ray</td>
</tr>
<tr>
<td>EEA</td>
<td>Energy &amp; Environmental Analysis, Inc.</td>
</tr>
<tr>
<td>EELS</td>
<td>Electron energy loss spectroscopy</td>
</tr>
<tr>
<td>EERE</td>
<td>U.S. DOE Office of Energy Efficiency and Renewable Energy</td>
</tr>
<tr>
<td>E₀XE₁</td>
<td>Utilization efficiency of incident solar light energy</td>
</tr>
<tr>
<td>EGR</td>
<td>Exhaust gas recirculation</td>
</tr>
<tr>
<td>EIA</td>
<td>Energy Information Administration of the U.S. Department of Energy</td>
</tr>
<tr>
<td>EIGA IGC</td>
<td>European Industrial Gases Association/Industrial Gases Council</td>
</tr>
<tr>
<td>EIS</td>
<td>Electrochemical impedance spectroscopy</td>
</tr>
<tr>
<td>ELAT®</td>
<td>Registered Trademark of De Nora North America, Inc., covers GDLs and GDEs</td>
</tr>
<tr>
<td>EM</td>
<td>Electromagnetic</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic compatibility</td>
</tr>
<tr>
<td>EMF</td>
<td>Enterprise modeling framework</td>
</tr>
<tr>
<td>EMI</td>
<td>Electro magnetic interference</td>
</tr>
<tr>
<td>EMTEC</td>
<td>Edison Materials Technology Center</td>
</tr>
<tr>
<td>eNMR</td>
<td>Electrochemical NMR</td>
</tr>
<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>EPR</td>
<td>Electron paramagnetic resonance</td>
</tr>
<tr>
<td>EPRI</td>
<td>Electric Power Research Institute</td>
</tr>
<tr>
<td>ER</td>
<td>Emergency responder</td>
</tr>
<tr>
<td>eRAM</td>
<td>Enterprise remote access monitoring</td>
</tr>
<tr>
<td>ESEM</td>
<td>Environmental scanning electron microscopy</td>
</tr>
<tr>
<td>eV</td>
<td>Electron volt</td>
</tr>
<tr>
<td>EW</td>
<td>Enthalpy wheel</td>
</tr>
<tr>
<td>EW</td>
<td>Equivalent weight</td>
</tr>
<tr>
<td>EXAFS</td>
<td>Extended x-ray absorption fine structure analysis</td>
</tr>
<tr>
<td>F</td>
<td>Fluorine</td>
</tr>
<tr>
<td>F</td>
<td>Faraday constant, the amount of electric charge in one mole of electrons (96,485.3383 coulomb/mole)</td>
</tr>
<tr>
<td>F-</td>
<td>Fluorine ion</td>
</tr>
<tr>
<td>FANS</td>
<td>Filter analyzer neutron spectroscopy</td>
</tr>
<tr>
<td>FAT</td>
<td>Fleet Analysis Toolkit</td>
</tr>
<tr>
<td>FBMR</td>
<td>Fluidized bed membrane reactor</td>
</tr>
<tr>
<td>FC</td>
<td>Fuel cell</td>
</tr>
<tr>
<td>FCB</td>
<td>Fuel cell bus</td>
</tr>
<tr>
<td>fcc</td>
<td>Face-centered cubic</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
</tr>
<tr>
<td>FCCP</td>
<td>Carbonyl cyanide m-chlorophenylhydrazone</td>
</tr>
<tr>
<td>FCE</td>
<td>FuelCell Energy</td>
</tr>
<tr>
<td>FCPF</td>
<td>FreedomCAR and Fuel Partnership</td>
</tr>
<tr>
<td>FCPP</td>
<td>Fuel cell power plant</td>
</tr>
<tr>
<td>FCS</td>
<td>Fuel cell system</td>
</tr>
<tr>
<td>FCT</td>
<td>Fuel Cell Technologies</td>
</tr>
<tr>
<td>FCTES</td>
<td>Fuel Cell Testing, Safety and Quality Assurance (an international effort to harmonize fuel cell testing procedures)</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>FCV</td>
<td>Fuel cell vehicle</td>
</tr>
<tr>
<td>Fd</td>
<td>Ferredoxin</td>
</tr>
<tr>
<td>FDA</td>
<td>Fleet Data Acquisition</td>
</tr>
<tr>
<td>FE</td>
<td>U.S. DOE Office of Fossil Energy</td>
</tr>
<tr>
<td>Fe</td>
<td>Iron</td>
</tr>
<tr>
<td>Fe$_2$O$_3$</td>
<td>Ferric oxide</td>
</tr>
<tr>
<td>FEA</td>
<td>Finite element analysis</td>
</tr>
<tr>
<td>FMEA</td>
<td>Failure mode effects analysis</td>
</tr>
<tr>
<td>FEP</td>
<td>Fluorinated ethylene propylene; Teflon®</td>
</tr>
<tr>
<td>FER</td>
<td>Fluoride emission rate</td>
</tr>
<tr>
<td>FERC</td>
<td>Federal Energy Regulatory Commission</td>
</tr>
<tr>
<td>FET</td>
<td>Field effect transistor</td>
</tr>
<tr>
<td>FFT</td>
<td>Fast fourier transform</td>
</tr>
<tr>
<td>FGHA</td>
<td>Forming gas hydrogen electrode</td>
</tr>
<tr>
<td>FMEAS</td>
<td>Failure modes and effects analysis</td>
</tr>
<tr>
<td>$^{19}$FMR</td>
<td>Fluorine nuclear magnetic resonance</td>
</tr>
<tr>
<td>FOM</td>
<td>Federated object modeling</td>
</tr>
<tr>
<td>FP</td>
<td>Fuel processor</td>
</tr>
<tr>
<td>fpm</td>
<td>Feet per minute</td>
</tr>
<tr>
<td>FPS</td>
<td>Fuel processing system</td>
</tr>
<tr>
<td>FR</td>
<td>Froude</td>
</tr>
<tr>
<td>Fr$_{DEN}$</td>
<td>Dense-centered Froude</td>
</tr>
<tr>
<td>FRP</td>
<td>Fiber-reinforced polymer</td>
</tr>
<tr>
<td>FSEC</td>
<td>Florida Solar Energy Center</td>
</tr>
<tr>
<td>F-SPEEK</td>
<td>Fluorosulfonic acid of polyetheretherketone</td>
</tr>
<tr>
<td>FST</td>
<td>FuelSell Technologies</td>
</tr>
<tr>
<td>ft</td>
<td>Feet</td>
</tr>
<tr>
<td>ft$^2$</td>
<td>Square feet</td>
</tr>
<tr>
<td>ft$^3$</td>
<td>Cubic feet</td>
</tr>
<tr>
<td>FTA</td>
<td>Federal Transit Administration</td>
</tr>
<tr>
<td>FTIR</td>
<td>Fourier transform infrared</td>
</tr>
<tr>
<td>FTIR-ATR</td>
<td>Fourier transform infrared attenuated total reflection</td>
</tr>
<tr>
<td>FTP</td>
<td>Federal Test Procedure</td>
</tr>
<tr>
<td>FWHM</td>
<td>Full width at half maximum</td>
</tr>
<tr>
<td>FY</td>
<td>Fiscal year</td>
</tr>
<tr>
<td>G</td>
<td>Graphite</td>
</tr>
<tr>
<td>G2</td>
<td>Generation-two</td>
</tr>
<tr>
<td>g</td>
<td>Gram; acceleration of gravity</td>
</tr>
<tr>
<td>g/cc</td>
<td>Grams per cubic centimeter</td>
</tr>
<tr>
<td>g/kW</td>
<td>Gram(s) per kilowatt</td>
</tr>
<tr>
<td>g/min</td>
<td>Grams per minute</td>
</tr>
<tr>
<td>g/s</td>
<td>Grams per second</td>
</tr>
<tr>
<td>Ga</td>
<td>Gallium</td>
</tr>
<tr>
<td>GaAs</td>
<td>Gallium arsenic</td>
</tr>
<tr>
<td>gal</td>
<td>Gallon</td>
</tr>
<tr>
<td>GAMS</td>
<td>Generalized Algebraic Modeling System, a commercially available software designed for linear and non-linear optimization</td>
</tr>
<tr>
<td>GaP</td>
<td>Gallium phosphide</td>
</tr>
<tr>
<td>GAS-PASS/H</td>
<td>Simulation code for gas-cooled nuclear reactors</td>
</tr>
<tr>
<td>GC</td>
<td>Gas chromatograph</td>
</tr>
<tr>
<td>GC</td>
<td>Glassy, or vitreous carbon; a pure carbon that is amorphous (non-crystalline)</td>
</tr>
<tr>
<td>GC/MS</td>
<td>Gas chromatograph/Mass spectroscopy</td>
</tr>
<tr>
<td>GCTOOL</td>
<td>Software package developed at ANL for analysis of fuel cells and other power systems</td>
</tr>
<tr>
<td>Gd</td>
<td>Gadolinium</td>
</tr>
<tr>
<td>GDC</td>
<td>Gadolinium-doped ceria</td>
</tr>
<tr>
<td>GDE</td>
<td>Gas diffusion electrode</td>
</tr>
<tr>
<td>GDL</td>
<td>Gas diffusion layer</td>
</tr>
<tr>
<td>GDM</td>
<td>Gas diffusion media</td>
</tr>
<tr>
<td>Ge</td>
<td>Germanium</td>
</tr>
<tr>
<td>GE</td>
<td>General Electric</td>
</tr>
<tr>
<td>Gen I</td>
<td>First generation</td>
</tr>
<tr>
<td>GES</td>
<td>Giner Electrochemical Systems, LLC</td>
</tr>
<tr>
<td>GF</td>
<td>Glass fiber</td>
</tr>
<tr>
<td>GGA</td>
<td>Gradient generalized approximation</td>
</tr>
<tr>
<td>GGE, gge</td>
<td>Gasoline gallon equivalent</td>
</tr>
<tr>
<td>GH$_2$</td>
<td>Gaseous hydrogen</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse gas</td>
</tr>
<tr>
<td>GHSV</td>
<td>Gas hourly space velocity</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic information system</td>
</tr>
<tr>
<td>GJ</td>
<td>Gigajoule(s)</td>
</tr>
<tr>
<td>g/kW</td>
<td>Gram(s) per kilowatt</td>
</tr>
<tr>
<td>GM</td>
<td>General Motors</td>
</tr>
<tr>
<td>gm</td>
<td>Gram(s)</td>
</tr>
<tr>
<td>gm/day</td>
<td>Gram(s) per day</td>
</tr>
<tr>
<td>g/min</td>
<td>Gram(s) per minute</td>
</tr>
<tr>
<td>GNF</td>
<td>Graphite nanofiber</td>
</tr>
<tr>
<td>GPa</td>
<td>Gigapascal(s)</td>
</tr>
<tr>
<td>GPS</td>
<td>Global positioning system</td>
</tr>
<tr>
<td>GREET</td>
<td>Greenhouse Gas Energy and Emissions in Transportation model</td>
</tr>
<tr>
<td>GRPE</td>
<td>Working Party on Pollution and Energy</td>
</tr>
<tr>
<td>GRSP</td>
<td>Working Party on Passive Safety</td>
</tr>
<tr>
<td>GTI</td>
<td>Gas Technology Institute</td>
</tr>
<tr>
<td>GTR</td>
<td>Global Technical Regulations</td>
</tr>
<tr>
<td>GV</td>
<td>Gasoline vehicle</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Meaning</td>
</tr>
<tr>
<td>--------------</td>
<td>---------</td>
</tr>
<tr>
<td>GW</td>
<td>Product of the Green’s function, G, and the energy, W</td>
</tr>
<tr>
<td>GWe</td>
<td>Gigawatt(s) electric</td>
</tr>
<tr>
<td>h</td>
<td>Hour(s)</td>
</tr>
<tr>
<td>H</td>
<td>Hydrogen</td>
</tr>
<tr>
<td>H+</td>
<td>Proton</td>
</tr>
<tr>
<td>ΔH</td>
<td>Enthalpy; heat of reaction</td>
</tr>
<tr>
<td>ΔH°f</td>
<td>Standard heat of formation</td>
</tr>
<tr>
<td>H₂</td>
<td>Diatomic hydrogen</td>
</tr>
<tr>
<td>H₂A</td>
<td>Hydrogen Analysis project sponsored by DOE</td>
</tr>
<tr>
<td>H₂cat</td>
<td>Catechol, 1,2 dihydroxybenzene</td>
</tr>
<tr>
<td>H₂Lib</td>
<td>Library of H₂ component models in Simulink</td>
</tr>
<tr>
<td>HAD</td>
<td>Hydrogen adsorption/desorption</td>
</tr>
<tr>
<td>HAMMER</td>
<td>Hazardous Materials Management and Emergency Response</td>
</tr>
<tr>
<td>HARI</td>
<td>Hydrogen and Renewables Integration (UK)</td>
</tr>
<tr>
<td>HATCI</td>
<td>Hyundai-KIA America Technical Center Inc.</td>
</tr>
<tr>
<td>HAZ</td>
<td>Heat affected zone</td>
</tr>
<tr>
<td>HAZID</td>
<td>Hazard Identification Analysis</td>
</tr>
<tr>
<td>HAZOP</td>
<td>Hazards and Operational Safety Analysis; Hazards and Operability Analysis</td>
</tr>
<tr>
<td>H-Bcat</td>
<td>Catecholborane where boron is bound to catecholate dianion and a hydride (B-H)</td>
</tr>
<tr>
<td>HBr</td>
<td>Hydrogen bromide</td>
</tr>
<tr>
<td>HBU</td>
<td>Hydrogen Based Unit</td>
</tr>
<tr>
<td>HCCI</td>
<td>Homogeneous charge compression ignition</td>
</tr>
<tr>
<td>HCl</td>
<td>Hydrochloric acid</td>
</tr>
<tr>
<td>HClO₄</td>
<td>Perchloric acid</td>
</tr>
<tr>
<td>HCNG</td>
<td>Hydrogen-compressed natural gas</td>
</tr>
<tr>
<td>HCO₃⁻</td>
<td>Bicarbonate</td>
</tr>
<tr>
<td>hcp</td>
<td>Hexagonal close-packed</td>
</tr>
<tr>
<td>HDPE</td>
<td>High-density polyethylene</td>
</tr>
<tr>
<td>HDSAM</td>
<td>Hydrogen Delivery Scenario Analysis Model</td>
</tr>
<tr>
<td>He</td>
<td>Helium</td>
</tr>
<tr>
<td>HER</td>
<td>Hydrogen evolution reaction</td>
</tr>
<tr>
<td>HEV</td>
<td>Hybrid electric vehicle</td>
</tr>
<tr>
<td>Hf</td>
<td>Hafnium</td>
</tr>
<tr>
<td>HF</td>
<td>Hydrogen Fueler</td>
</tr>
<tr>
<td>HF</td>
<td>Hydrofluorhydric acid; hydrogen fluoride</td>
</tr>
<tr>
<td>HFC</td>
<td>Hydrogen fuel cell</td>
</tr>
<tr>
<td>HFI</td>
<td>Hydrogen Fuel Initiative</td>
</tr>
<tr>
<td>HFR</td>
<td>High-frequency impedance; high-frequency resistance</td>
</tr>
<tr>
<td>HFS</td>
<td>Hydrogen filling station</td>
</tr>
<tr>
<td>HGM</td>
<td>Hydrogen Generation Module</td>
</tr>
<tr>
<td>HGMs</td>
<td>Hollow glass microspheres</td>
</tr>
<tr>
<td>HGV4</td>
<td>Hydrogen Gas Powered Vehicle – 4</td>
</tr>
<tr>
<td>HHV</td>
<td>Higher heating value</td>
</tr>
<tr>
<td>HI</td>
<td>Hydrogen iodide</td>
</tr>
<tr>
<td>HIA</td>
<td>Hydrogen Implementing Agreement</td>
</tr>
<tr>
<td>H₂ICE</td>
<td>Hydrogen-fueled internal combustion engine</td>
</tr>
<tr>
<td>H-IPCo</td>
<td>High-pressure carbon monoxide</td>
</tr>
<tr>
<td>HIPOC</td>
<td>Hydrogen Industry Panel on Codes</td>
</tr>
<tr>
<td>Hix</td>
<td>Blend of hydrogen iodide, iodine, and water</td>
</tr>
<tr>
<td>HLA</td>
<td>High level architecture</td>
</tr>
<tr>
<td>HMC</td>
<td>Hyundai Motor Company</td>
</tr>
<tr>
<td>HMM</td>
<td>Hidden Markov Model</td>
</tr>
<tr>
<td>HNEI</td>
<td>Hawaii Natural Energy Institute</td>
</tr>
<tr>
<td>HNO₃</td>
<td>Nitric acid</td>
</tr>
<tr>
<td>H₂O</td>
<td>Water</td>
</tr>
<tr>
<td>H₂O₂</td>
<td>Hydrogen peroxide</td>
</tr>
<tr>
<td>HOMO</td>
<td>Highest occupied molecular orbital</td>
</tr>
<tr>
<td>HOR</td>
<td>Hydrogen oxidation reaction</td>
</tr>
<tr>
<td>HP</td>
<td>High-pressure</td>
</tr>
<tr>
<td>hp</td>
<td>Horsepower</td>
</tr>
<tr>
<td>HPA</td>
<td>Heteropolyacid</td>
</tr>
<tr>
<td>HPC</td>
<td>Highly porous carbon</td>
</tr>
<tr>
<td>HPE</td>
<td>Hybrid photoelectrode</td>
</tr>
<tr>
<td>HPFC</td>
<td>Hydrogen polymer electrolyte membrane fuel cell</td>
</tr>
<tr>
<td>HPLC</td>
<td>High performance liquid chromatograph</td>
</tr>
<tr>
<td>H₃PO₄</td>
<td>Phosphoric acid</td>
</tr>
<tr>
<td>hr</td>
<td>Hour(s)</td>
</tr>
<tr>
<td>HRL</td>
<td>HRL Laboratories, LLC</td>
</tr>
<tr>
<td>HRTEM</td>
<td>High-resolution transmission electron microscopy</td>
</tr>
<tr>
<td>H₂S</td>
<td>Hydrogen sulfide</td>
</tr>
<tr>
<td>HSC</td>
<td>Database name derived from the letters for enthalpy, entropy and heat capacity</td>
</tr>
<tr>
<td>HSDC</td>
<td>Hydrogen Secure Data Center</td>
</tr>
<tr>
<td>HSE</td>
<td>Health, safety and environmental</td>
</tr>
<tr>
<td>HSO₄⁻</td>
<td>Bisulfate anion</td>
</tr>
<tr>
<td>Acronym</td>
<td>Abbreviation/Description</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>H₂SO₄</td>
<td>Sulfuric acid</td>
</tr>
<tr>
<td>HSRP</td>
<td>Hydrogen Safety Review Panel</td>
</tr>
<tr>
<td>HT</td>
<td>High-temperature</td>
</tr>
<tr>
<td>HTE</td>
<td>High-temperature electrolysis</td>
</tr>
<tr>
<td>HTF</td>
<td>Heat transfer fluid</td>
</tr>
<tr>
<td>HTFC</td>
<td>High-temperature fuel cell</td>
</tr>
<tr>
<td>HTGR</td>
<td>High-temperature gas-cooled reactor</td>
</tr>
<tr>
<td>HTHX</td>
<td>High-temperature heat exchanger</td>
</tr>
<tr>
<td>HTM</td>
<td>High-temperature membrane</td>
</tr>
<tr>
<td>HTM</td>
<td>Hydrogen transport membrane</td>
</tr>
<tr>
<td>HTMWG</td>
<td>High Temperature Membrane Working Group</td>
</tr>
<tr>
<td>HTS</td>
<td>High-temperature shift; high-throughput screening</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, ventilation and cooling</td>
</tr>
<tr>
<td>HWFET</td>
<td>Highway Fuel Economy Test</td>
</tr>
<tr>
<td>HX</td>
<td>Heat exchanger</td>
</tr>
<tr>
<td>HyARC</td>
<td>Hydrogen Analysis Resource Center</td>
</tr>
<tr>
<td>Hydrofill™</td>
<td>GTI hydrogen dispenser filling control algorithm</td>
</tr>
<tr>
<td>HyDS</td>
<td>Hydrogen deployment system model</td>
</tr>
<tr>
<td>HyDS ME</td>
<td>HyDS modeling environment</td>
</tr>
<tr>
<td>HYSYS®</td>
<td>Process simulation software by Aspentech</td>
</tr>
<tr>
<td>Hythane</td>
<td>Compressed hydrogen natural gas blend</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz</td>
</tr>
<tr>
<td>i</td>
<td>Current density (mA/cm²)</td>
</tr>
<tr>
<td>I</td>
<td>Current</td>
</tr>
<tr>
<td>I₂</td>
<td>Diatomic iodine</td>
</tr>
<tr>
<td>IBAD</td>
<td>Ion beam assisted deposition</td>
</tr>
<tr>
<td>IBS</td>
<td>Ion beam sputtering</td>
</tr>
<tr>
<td>IC</td>
<td>Internal combustion</td>
</tr>
<tr>
<td>ICC</td>
<td>International Code Council</td>
</tr>
<tr>
<td>ICE</td>
<td>Internal combustion engine</td>
</tr>
<tr>
<td>ICEV</td>
<td>Internal combustion engine vehicle</td>
</tr>
<tr>
<td>ICM</td>
<td>Idealized city model</td>
</tr>
<tr>
<td>ICMS</td>
<td>Integrated ceramic membrane system</td>
</tr>
<tr>
<td>ICP</td>
<td>Inductively coupled plasma</td>
</tr>
<tr>
<td>ICP-MS</td>
<td>Inductively coupled plasma mass spectrometry</td>
</tr>
<tr>
<td>ICR</td>
<td>Interfacial contact resistance</td>
</tr>
<tr>
<td>ICSD</td>
<td>Inorganic Crystal Structure Database</td>
</tr>
<tr>
<td>ICU</td>
<td>Isotherm characterization unit</td>
</tr>
<tr>
<td>ID, i.d.</td>
<td>Internal diameter</td>
</tr>
<tr>
<td>IEA</td>
<td>International Energy Agency</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>IEC</td>
<td>Ion exchange capacity</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers, Inc.</td>
</tr>
<tr>
<td>IGCC</td>
<td>Integrated gasification combined cycle</td>
</tr>
<tr>
<td>IGS</td>
<td>Industrial gas supplier</td>
</tr>
<tr>
<td>IGT</td>
<td>Institute of Gas Technology</td>
</tr>
<tr>
<td>In</td>
<td>Indium</td>
</tr>
<tr>
<td>In²</td>
<td>Square inch</td>
</tr>
<tr>
<td>INERI</td>
<td>International Nuclear Energy Research Initiative</td>
</tr>
<tr>
<td>INL</td>
<td>Idaho National Laboratory</td>
</tr>
<tr>
<td>InP</td>
<td>Indium phosphorus</td>
</tr>
<tr>
<td>IP</td>
<td>Intellectual property</td>
</tr>
<tr>
<td>IPE</td>
<td>Integrated photovoltaic electrolysis</td>
</tr>
<tr>
<td>IPHE</td>
<td>International Partnership for the Hydrogen Economy</td>
</tr>
<tr>
<td>IPNS</td>
<td>Intense Pulse Neutron Scattering Facility at Argonne National Laboratory</td>
</tr>
<tr>
<td>IR</td>
<td>Infrared</td>
</tr>
<tr>
<td>Ir</td>
<td>Iridium</td>
</tr>
<tr>
<td>iR</td>
<td>Internal resistance; voltage loss due to resistance</td>
</tr>
<tr>
<td>IRMOF</td>
<td>Isoreticular metal organic framework</td>
</tr>
<tr>
<td>IRR</td>
<td>Internal rate of return</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization; International Standards Organization</td>
</tr>
<tr>
<td>ISS</td>
<td>Ion scattering spectroscopy</td>
</tr>
<tr>
<td>ITM</td>
<td>Ion transport membrane</td>
</tr>
<tr>
<td>ITO</td>
<td>Indium tin oxide</td>
</tr>
<tr>
<td>I-V</td>
<td>Current-voltage</td>
</tr>
<tr>
<td>J</td>
<td>Current</td>
</tr>
<tr>
<td>J Joule(s)</td>
<td></td>
</tr>
<tr>
<td>JM</td>
<td>Johnson Matthey</td>
</tr>
<tr>
<td>JMFC</td>
<td>Johnson-Matthey Fuel Cells</td>
</tr>
<tr>
<td>JPL</td>
<td>Jet Propulsion Laboratory</td>
</tr>
<tr>
<td>Jsc</td>
<td>Short circuit current density</td>
</tr>
<tr>
<td>K</td>
<td>Kelvin</td>
</tr>
<tr>
<td>K</td>
<td>Potassium</td>
</tr>
<tr>
<td>Kₜₙ</td>
<td>Hydrogen-assisted crack growth threshold</td>
</tr>
<tr>
<td>kÅ</td>
<td>1000 angstroms</td>
</tr>
<tr>
<td>KAERI</td>
<td>Korea Atomic Energy Research Institute</td>
</tr>
<tr>
<td>kA/m²</td>
<td>Kilo-ampere(s) per square meter</td>
</tr>
<tr>
<td>kb</td>
<td>Kilo-base pair, a unit of measurement used in genetics equal to 1,000 nucleotides</td>
</tr>
<tr>
<td>Acronym</td>
<td>Abbreviation</td>
</tr>
<tr>
<td>---------</td>
<td>--------------</td>
</tr>
<tr>
<td>KBr</td>
<td>Potassium bromide</td>
</tr>
<tr>
<td>kcal</td>
<td>Kilocalorie(s)</td>
</tr>
<tr>
<td>kcal/mol</td>
<td>Kilocalorie(s) per mole</td>
</tr>
<tr>
<td>KeV</td>
<td>Kilo electron volt(s)</td>
</tr>
<tr>
<td>kg</td>
<td>Kilogram(s)</td>
</tr>
<tr>
<td>kg/day</td>
<td>Kilogram(s) per day</td>
</tr>
<tr>
<td>kg/hr</td>
<td>Kilogram(s) per hour</td>
</tr>
<tr>
<td>kg/m³</td>
<td>Kilogram(s) per cubic meter</td>
</tr>
<tr>
<td>KH</td>
<td>Potassium hydride</td>
</tr>
<tr>
<td>kHz</td>
<td>KiloHertz</td>
</tr>
<tr>
<td>kJ</td>
<td>Kilojoule(s)</td>
</tr>
<tr>
<td>kJ/mol</td>
<td>Kilojoule(s) per mole</td>
</tr>
<tr>
<td>km</td>
<td>Kilometer(s)</td>
</tr>
<tr>
<td>KMC</td>
<td>Kia Motors Corporation</td>
</tr>
<tr>
<td>KOH</td>
<td>Potassium hydroxide</td>
</tr>
<tr>
<td>kPa</td>
<td>Kilopascal(s)</td>
</tr>
<tr>
<td>kph</td>
<td>Kilometer(s) per hour</td>
</tr>
<tr>
<td>ksi</td>
<td>1,000 pound-force per square inch</td>
</tr>
<tr>
<td>kT/y</td>
<td>Kiloton(s) per year</td>
</tr>
<tr>
<td>kW</td>
<td>Kilowatt(s)</td>
</tr>
<tr>
<td>kWe</td>
<td>Kilowatt(s) electric</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatt-hour(s)</td>
</tr>
<tr>
<td>kWh/kg</td>
<td>Kilowatt-hour(s) per kilogram</td>
</tr>
<tr>
<td>kWh/L</td>
<td>Kilowatt-hour(s) per liter</td>
</tr>
<tr>
<td>kW/kg</td>
<td>Kilowatt(s) per kilogram</td>
</tr>
<tr>
<td>kWt</td>
<td>Kilowatt(s) thermal</td>
</tr>
<tr>
<td>L, l</td>
<td>Liter(s)</td>
</tr>
<tr>
<td>La</td>
<td>Lanthanum</td>
</tr>
<tr>
<td>λ</td>
<td>Lambda, hydration number</td>
</tr>
<tr>
<td>LANL</td>
<td>Los Alamos National Laboratory</td>
</tr>
<tr>
<td>LAO</td>
<td>Lanthanum-modified alumina</td>
</tr>
<tr>
<td>LAX</td>
<td>Los Angeles International Airport</td>
</tr>
<tr>
<td>lb</td>
<td>Pound(s)</td>
</tr>
<tr>
<td>lbmol</td>
<td>Pound-mole(s)</td>
</tr>
<tr>
<td>LBNL</td>
<td>Lawrence Berkeley National Laboratory</td>
</tr>
<tr>
<td>LCA</td>
<td>Life cycle assessment</td>
</tr>
<tr>
<td>LCC</td>
<td>Lansing Community College</td>
</tr>
<tr>
<td>LCC</td>
<td>Lanthanum</td>
</tr>
<tr>
<td>LCHPP</td>
<td>Low Cost Hydrogen Production Platform (DOE Program Title)</td>
</tr>
<tr>
<td>LCI</td>
<td>Life cycle inventory</td>
</tr>
<tr>
<td>L/D</td>
<td>Ratio of length to diameter</td>
</tr>
<tr>
<td>LDC</td>
<td>Local Distribution Company</td>
</tr>
<tr>
<td>LDMS</td>
<td>Laser modulated differential spectroscopy</td>
</tr>
<tr>
<td>LDV</td>
<td>Light-duty vehicle</td>
</tr>
<tr>
<td>LECO</td>
<td>Instrument for fixed oxygen determination</td>
</tr>
<tr>
<td>LEED</td>
<td>Low-energy electron diffraction</td>
</tr>
<tr>
<td>LEEM</td>
<td>Low-energy electron microscopy</td>
</tr>
<tr>
<td>LEIS</td>
<td>Low-energy ion scattering</td>
</tr>
<tr>
<td>LEL</td>
<td>Lower explosion limit</td>
</tr>
<tr>
<td>LEMSYS</td>
<td>Local Energy Management System</td>
</tr>
<tr>
<td>LFL</td>
<td>Lower flammability limit</td>
</tr>
<tr>
<td>L/h, l/h</td>
<td>Liter(s) per hour</td>
</tr>
<tr>
<td>LH₂</td>
<td>Liquid hydrogen</td>
</tr>
<tr>
<td>LHC</td>
<td>Light-harvesting chlorophyll</td>
</tr>
<tr>
<td>LHSV</td>
<td>Liquid hourly space velocity</td>
</tr>
<tr>
<td>LHV</td>
<td>Lower heating value</td>
</tr>
<tr>
<td>Li</td>
<td>Lithium</td>
</tr>
<tr>
<td>LiBH₄</td>
<td>Lithium borohydride</td>
</tr>
<tr>
<td>LiH</td>
<td>Lithium hydride</td>
</tr>
<tr>
<td>Li₃N</td>
<td>Lithium nitride</td>
</tr>
<tr>
<td>LLC</td>
<td>Limited Liability Company</td>
</tr>
<tr>
<td>LLNL</td>
<td>Lawrence Livermore National Laboratory</td>
</tr>
<tr>
<td>LMDS</td>
<td>Laser modulation differential spectroscopy</td>
</tr>
<tr>
<td>L/min, l/min</td>
<td>Liter(s) per minute</td>
</tr>
<tr>
<td>LNG</td>
<td>Liquefied natural gas</td>
</tr>
<tr>
<td>LOPA</td>
<td>Layer of protection analysis</td>
</tr>
<tr>
<td>LP</td>
<td>Lattice parameter</td>
</tr>
<tr>
<td>LPG</td>
<td>Liquefied petroleum gas</td>
</tr>
<tr>
<td>LPM</td>
<td>Liters per minute</td>
</tr>
<tr>
<td>LSC</td>
<td>Lanthanum strontium cobalt oxide, ((\text{La, Sr})\text{CoO}_3)</td>
</tr>
<tr>
<td>LSCM</td>
<td>Lanthanum strontium chromium manganese oxide, ((\text{La, Sr})\text{(Cr, Mn)}\text{O}_3)</td>
</tr>
<tr>
<td>LSCr</td>
<td>Lanthanum strontium chromium oxide, ((\text{La, Sr})\text{CrO}_3)</td>
</tr>
<tr>
<td>LSM</td>
<td>Lanthanum strontium manganese oxide, ((\text{La, Sr})\text{MnO}_3)</td>
</tr>
<tr>
<td>LTU</td>
<td>Lawrence Technological University</td>
</tr>
<tr>
<td>LWR</td>
<td>Light water reactor</td>
</tr>
<tr>
<td>LUMO</td>
<td>Lowest unoccupied molecular orbital</td>
</tr>
<tr>
<td>LVVWD</td>
<td>Las Vegas Valley Water District</td>
</tr>
<tr>
<td>m</td>
<td>Meter(s)</td>
</tr>
<tr>
<td>M</td>
<td>Molar</td>
</tr>
<tr>
<td>m²</td>
<td>Square meter(s)</td>
</tr>
<tr>
<td>m³</td>
<td>Cubic meter(s)</td>
</tr>
<tr>
<td>m²/g</td>
<td>Square meter(s) per gram</td>
</tr>
<tr>
<td>m²/s</td>
<td>Square meter(s) per second</td>
</tr>
<tr>
<td>M31</td>
<td>Arkema’s First-Generation Membrane Candidate</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>M40</td>
<td>Arkema’s Second-Generation Membrane Candidate</td>
</tr>
<tr>
<td>mA</td>
<td>MilliAmps</td>
</tr>
<tr>
<td>µA</td>
<td>Micro ampere(s)</td>
</tr>
<tr>
<td>mA/cm²</td>
<td>Milliamp(s) per square centimeter</td>
</tr>
<tr>
<td>µA/cm²</td>
<td>Micro ampere(s) per square centimeter</td>
</tr>
<tr>
<td>MACRS</td>
<td>Modified Accelerated Cost Recovery Schedule</td>
</tr>
<tr>
<td>MARKAL</td>
<td>Market Allocation Model - A generic, multi-sector energy model developed by</td>
</tr>
<tr>
<td></td>
<td>the Energy Technology Systems Analysis Program of the International Energy</td>
</tr>
<tr>
<td></td>
<td>Agency</td>
</tr>
<tr>
<td>MAS</td>
<td>Magic angle spinning</td>
</tr>
<tr>
<td>MAS-NMR</td>
<td>Magic angle spinning nuclear magnetic resonance</td>
</tr>
<tr>
<td>MBE</td>
<td>Molecular beam epitaxy</td>
</tr>
<tr>
<td>MBMS</td>
<td>Molecular beam mass spectrometry</td>
</tr>
<tr>
<td>MC</td>
<td>Monte Carlo</td>
</tr>
<tr>
<td>mC-cm²</td>
<td>MilliCoulomb(s) per square centimeter</td>
</tr>
<tr>
<td>MCEL</td>
<td>Millenium Cell, Inc.</td>
</tr>
<tr>
<td>MCFE</td>
<td>Molten carbonic fuel cell</td>
</tr>
<tr>
<td>MD</td>
<td>Molecular dynamics</td>
</tr>
<tr>
<td>MDCA</td>
<td>Metal-doped carbon aerogels</td>
</tr>
<tr>
<td>MEA</td>
<td>Membrane-electrode assembly</td>
</tr>
<tr>
<td>MEMS</td>
<td>Micro-electro-mechanical systems</td>
</tr>
<tr>
<td>MEMSYS</td>
<td>Micro-grid Energy Management System</td>
</tr>
<tr>
<td>MeOH</td>
<td>Methanol</td>
</tr>
<tr>
<td>meq</td>
<td>Milliequivalents</td>
</tr>
<tr>
<td>meq/g</td>
<td>Milliequivalents/gram</td>
</tr>
<tr>
<td>MetCars</td>
<td>Metal-carbon systems</td>
</tr>
<tr>
<td>MeV</td>
<td>Mega electron volt</td>
</tr>
<tr>
<td>Mg</td>
<td>Magnesium</td>
</tr>
<tr>
<td>Mg</td>
<td>Megagram(s)</td>
</tr>
<tr>
<td>µg</td>
<td>Microgram(s)</td>
</tr>
<tr>
<td>mg</td>
<td>Milligram(s)</td>
</tr>
<tr>
<td>Mg(OH)₂</td>
<td>Magnesium hydroxide</td>
</tr>
<tr>
<td>mg/cm²</td>
<td>Milligram(s) per square centimeter</td>
</tr>
<tr>
<td>MgCl₂</td>
<td>Magnesium chloride</td>
</tr>
<tr>
<td>MgH₂</td>
<td>Magnesium hydride</td>
</tr>
<tr>
<td>MH</td>
<td>Metal hydride</td>
</tr>
<tr>
<td>MHC</td>
<td>Metal hydride compressor</td>
</tr>
<tr>
<td>MHCoE</td>
<td>Metal Hydride Center of Excellence</td>
</tr>
<tr>
<td>MHz</td>
<td>Megahertz</td>
</tr>
<tr>
<td>MI</td>
<td>Melt infiltration</td>
</tr>
<tr>
<td>mi</td>
<td>Mile(s)</td>
</tr>
<tr>
<td>mi/kg</td>
<td>Mile(s) per kilogram</td>
</tr>
<tr>
<td>mil</td>
<td>Millimeter(s)</td>
</tr>
<tr>
<td>min</td>
<td>Minute(s)</td>
</tr>
<tr>
<td>MIT</td>
<td>Massachusetts Institute of Technology</td>
</tr>
<tr>
<td>MJ</td>
<td>Megajoule(s)</td>
</tr>
<tr>
<td>ML</td>
<td>Monolayer</td>
</tr>
<tr>
<td>mL, ml</td>
<td>Milliliter(s)</td>
</tr>
<tr>
<td>µm</td>
<td>Micrometer(s); micron(s)</td>
</tr>
<tr>
<td>µM</td>
<td>Micromolar</td>
</tr>
<tr>
<td>mM</td>
<td>Millimolar</td>
</tr>
<tr>
<td>mm</td>
<td>Millimeter(s)</td>
</tr>
<tr>
<td>MMBl</td>
<td>Million British thermal units</td>
</tr>
<tr>
<td>mmol</td>
<td>Millimole(s)</td>
</tr>
<tr>
<td>MMOM</td>
<td>Microporous metal organic materials</td>
</tr>
<tr>
<td>µmol</td>
<td>Micromole(s)</td>
</tr>
<tr>
<td>Mn</td>
<td>Manganese</td>
</tr>
<tr>
<td>MnO</td>
<td>Manganese oxide</td>
</tr>
<tr>
<td>Mn₂O₃</td>
<td>Manganese oxide</td>
</tr>
<tr>
<td>MΩ</td>
<td>Mega-ohm(s)</td>
</tr>
<tr>
<td>mΩ</td>
<td>Milli-ohm(s)</td>
</tr>
<tr>
<td>µΩ-cm²</td>
<td>Micro-ohm(s) - square centimeter</td>
</tr>
<tr>
<td>mΩ/cm²</td>
<td>Milli-ohm(s) per square centimeter</td>
</tr>
<tr>
<td>MOF</td>
<td>Metal-organic framework</td>
</tr>
<tr>
<td>Mo</td>
<td>Molybdenum</td>
</tr>
<tr>
<td>mol</td>
<td>Mole(s)</td>
</tr>
<tr>
<td>mol%</td>
<td>Mole percent</td>
</tr>
<tr>
<td>mol/min</td>
<td>Mole(s) per minute</td>
</tr>
<tr>
<td>MoPc</td>
<td>Molybdenum phthalocyanine</td>
</tr>
<tr>
<td>MOVES</td>
<td>Motor Vehicle Emission Simulator</td>
</tr>
<tr>
<td>MPa</td>
<td>Megapascal</td>
</tr>
<tr>
<td>MPG, mpg</td>
<td>Mile(s) per gallon</td>
</tr>
<tr>
<td>mph</td>
<td>Mile(s) per hour</td>
</tr>
<tr>
<td>MPL</td>
<td>Microporous layer</td>
</tr>
<tr>
<td>MR</td>
<td>Membrane reactor</td>
</tr>
<tr>
<td>MRI</td>
<td>Magnetic resonance imaging</td>
</tr>
<tr>
<td>mRNA</td>
<td>message RNA</td>
</tr>
<tr>
<td>MRS</td>
<td>Materials Research Society</td>
</tr>
<tr>
<td>ms</td>
<td>Millisecond(s)</td>
</tr>
<tr>
<td>mS/cm</td>
<td>Milli-Siemen(s) per centimeter</td>
</tr>
<tr>
<td>MS</td>
<td>Mass spectrometer</td>
</tr>
<tr>
<td>MS-EVB</td>
<td>Multi-state empirical valence bond</td>
</tr>
<tr>
<td>MSHA</td>
<td>Mine Safety and Health Administration</td>
</tr>
<tr>
<td>MSM</td>
<td>Macro-System Model</td>
</tr>
<tr>
<td>MSP</td>
<td>Molten state processing</td>
</tr>
<tr>
<td>MSRI</td>
<td>Materials and Systems Research, Inc.</td>
</tr>
<tr>
<td>MSU</td>
<td>Montana State University</td>
</tr>
<tr>
<td>MSW</td>
<td>Municipal solid waste</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>MT</td>
<td>Mass transport</td>
</tr>
<tr>
<td>MTO</td>
<td>Mass transport overpotential</td>
</tr>
<tr>
<td>μV</td>
<td>Micro volt(s)</td>
</tr>
<tr>
<td>mV</td>
<td>Millivolt(s)</td>
</tr>
<tr>
<td>mW</td>
<td>Milliwatt(s)</td>
</tr>
<tr>
<td>MW</td>
<td>Megawatt(s)</td>
</tr>
<tr>
<td>MW</td>
<td>Molecular weight</td>
</tr>
<tr>
<td>mW/cm²</td>
<td>Milliwatt(s) per square centimeter</td>
</tr>
<tr>
<td>MWt</td>
<td>Megawatt(s) electric</td>
</tr>
<tr>
<td>MWth</td>
<td>Megawatt-hour(s)</td>
</tr>
<tr>
<td>MWNT</td>
<td>Multi-wall carbon nanotubes</td>
</tr>
<tr>
<td>MWOE</td>
<td>Midwest Optoelectronics, LLC</td>
</tr>
<tr>
<td>MYPP</td>
<td>Multi-Year Program Plan (the HFCIT Program’s Multi-Year Research, Development and Demonstration Plan)</td>
</tr>
<tr>
<td>MYRDDP</td>
<td>Multi-Year Research, Development and Demonstration Plan</td>
</tr>
<tr>
<td>N</td>
<td>Normal (e.g., 1N H₃PO₄ is 1 normal solution of phosphoric acid)</td>
</tr>
<tr>
<td>N</td>
<td>Nitrogen atom</td>
</tr>
<tr>
<td>N</td>
<td>Newton (unit of force)</td>
</tr>
<tr>
<td>N/cm²</td>
<td>Newton(s) per square centimeter</td>
</tr>
<tr>
<td>N112</td>
<td>Nafion® 1100 equivalent weight, 2 millimeter thick membrane</td>
</tr>
<tr>
<td>N₂</td>
<td>Diatomic nitrogen</td>
</tr>
<tr>
<td>Na</td>
<td>Sodium</td>
</tr>
<tr>
<td>NA</td>
<td>North American</td>
</tr>
<tr>
<td>Na₃AlH₄</td>
<td>Trisodium hexahydroaluminate</td>
</tr>
<tr>
<td>NaAlH₄</td>
<td>Sodium aluminum hydride; sodium tetrahydroaluminate; sodium alanate</td>
</tr>
<tr>
<td>NaBH₄</td>
<td>Sodium borohydride</td>
</tr>
<tr>
<td>NaBO₂</td>
<td>Sodium borate</td>
</tr>
<tr>
<td>NACE</td>
<td>National Association of Corrosion Engineers</td>
</tr>
<tr>
<td>NaCl</td>
<td>Sodium chloride</td>
</tr>
<tr>
<td>NACS</td>
<td>North American Catalysis Society</td>
</tr>
<tr>
<td>Nafion®</td>
<td>Registered Trademark of E.I. DuPont de Nemours</td>
</tr>
<tr>
<td>NaH</td>
<td>Sodium hydride</td>
</tr>
<tr>
<td>NA NG</td>
<td>North American natural gas</td>
</tr>
<tr>
<td>NaOH</td>
<td>Sodium hydroxide</td>
</tr>
<tr>
<td>Na₂S</td>
<td>Sodium sulfide</td>
</tr>
<tr>
<td>NAS</td>
<td>National Academy of Sciences</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
</tr>
<tr>
<td>NAU</td>
<td>Northern Arizona University</td>
</tr>
<tr>
<td>Nb</td>
<td>Niobium</td>
</tr>
<tr>
<td>nc-Si:H</td>
<td>Nanocrystalline silicon</td>
</tr>
<tr>
<td>NCMS</td>
<td>National Center for Manufacturing Sciences</td>
</tr>
<tr>
<td>NCNR</td>
<td>NIST Center for Neutron Research</td>
</tr>
<tr>
<td>ND</td>
<td>Not determined at this time</td>
</tr>
<tr>
<td>NDA</td>
<td>Non-disclosure agreement</td>
</tr>
<tr>
<td>NDC</td>
<td>New Delivery Concept</td>
</tr>
<tr>
<td>NE</td>
<td>U.S. DOE Office of Nuclear Energy, Science and Technology</td>
</tr>
<tr>
<td>NEBS</td>
<td>Network Equipment Building Standards</td>
</tr>
<tr>
<td>NEC</td>
<td>NextEnergy Center</td>
</tr>
<tr>
<td>NEC</td>
<td>National Electrical Code</td>
</tr>
<tr>
<td>NEED</td>
<td>National Energy Education Development Project</td>
</tr>
<tr>
<td>NEMS</td>
<td>National Energy Modeling System</td>
</tr>
<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
</tr>
<tr>
<td>NERI</td>
<td>Nuclear Energy Research Initiative</td>
</tr>
<tr>
<td>NETL</td>
<td>National Energy Technology Laboratory</td>
</tr>
<tr>
<td>NFCRC</td>
<td>National Fuel Cell Research Center</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>NG</td>
<td>Natural gas</td>
</tr>
<tr>
<td>ng</td>
<td>Nanogram</td>
</tr>
<tr>
<td>NGCC</td>
<td>Natural gas combined cycle</td>
</tr>
<tr>
<td>NGNP</td>
<td>Next Generation Nuclear Plant</td>
</tr>
<tr>
<td>NH₃</td>
<td>Ammonia</td>
</tr>
<tr>
<td>NHA</td>
<td>National Hydrogen Association</td>
</tr>
<tr>
<td>NHE</td>
<td>Normal hydrogen electrode</td>
</tr>
<tr>
<td>NHFC4</td>
<td>National Hydrogen and Fuel Cells Codes and Standards Coordinating Committee</td>
</tr>
<tr>
<td>NHI</td>
<td>Nuclear Hydrogen Initiative</td>
</tr>
<tr>
<td>NHTSA</td>
<td>National Highway Traffic Safety Administration of the U.S. Department of Transportation</td>
</tr>
<tr>
<td>Ni</td>
<td>Nickel</td>
</tr>
<tr>
<td>NILS</td>
<td>Normal interstitial lattice sites</td>
</tr>
<tr>
<td>NiMH</td>
<td>Nickel metal hydride</td>
</tr>
<tr>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
</tr>
<tr>
<td>NL</td>
<td>Normal liter(s)</td>
</tr>
<tr>
<td>NLDFT</td>
<td>Non-local density functional theory</td>
</tr>
<tr>
<td>nm</td>
<td>Nanometer(s)</td>
</tr>
<tr>
<td>NM</td>
<td>Noble metal</td>
</tr>
<tr>
<td>NMR</td>
<td>Nuclear magnetic resonance</td>
</tr>
<tr>
<td>Nm³/h, nm³/hr</td>
<td>Normal cubic meter(s) per hour</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>nmol</td>
<td>Nanomole(s)</td>
</tr>
<tr>
<td>NNA</td>
<td>Non-North American</td>
</tr>
<tr>
<td>NNA NG</td>
<td>Non-North American natural gas</td>
</tr>
<tr>
<td>NNIF</td>
<td>NIST neutron imaging facility</td>
</tr>
<tr>
<td>NNSA</td>
<td>National Nuclear Security Administration</td>
</tr>
<tr>
<td>NMR</td>
<td>Nuclear magnetic resonance</td>
</tr>
<tr>
<td>NMSU</td>
<td>New Mexico State University</td>
</tr>
<tr>
<td>NM Tech</td>
<td>New Mexico Technological University</td>
</tr>
<tr>
<td>NO₂</td>
<td>Nitric oxide</td>
</tr>
<tr>
<td>N₂O</td>
<td>Nitrous oxide</td>
</tr>
<tr>
<td>NOx</td>
<td>Oxides of nitrogen</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>NPC</td>
<td>Nanoporous carbon</td>
</tr>
<tr>
<td>NPD</td>
<td>Neutron powder diffraction</td>
</tr>
<tr>
<td>NPM</td>
<td>Non-precious metal</td>
</tr>
<tr>
<td>NPT</td>
<td>Normal pressure and temperature</td>
</tr>
<tr>
<td>NPV</td>
<td>Net present value</td>
</tr>
<tr>
<td>NRC</td>
<td>National Research Council</td>
</tr>
<tr>
<td>NRECA</td>
<td>National Rural Electric Cooperative Association</td>
</tr>
<tr>
<td>NREL</td>
<td>National Renewable Energy Laboratory</td>
</tr>
<tr>
<td>NSF</td>
<td>National Science Foundation</td>
</tr>
<tr>
<td>NSTF</td>
<td>Nanostructured thin film</td>
</tr>
<tr>
<td>NVS</td>
<td>Neutron vibrational spectroscopy</td>
</tr>
<tr>
<td>NYSERDA</td>
<td>New York State Energy Research and Development Authority</td>
</tr>
<tr>
<td>O</td>
<td>Oxygen</td>
</tr>
<tr>
<td>O₂</td>
<td>Diatomic oxygen</td>
</tr>
<tr>
<td>O/C</td>
<td>Oxygen-to-carbon atomic ratio</td>
</tr>
<tr>
<td>OCP</td>
<td>Open circuit potential</td>
</tr>
<tr>
<td>OCV</td>
<td>Open circuit voltage</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Operation and maintenance</td>
</tr>
<tr>
<td>OMB</td>
<td>Office of Management and Budget</td>
</tr>
<tr>
<td>ORF</td>
<td>Opening Reading Frame indicating the occurrence of a protein coding region in the DNA sequence</td>
</tr>
<tr>
<td>ORNL</td>
<td>Oak Ridge National Laboratory</td>
</tr>
<tr>
<td>ORR</td>
<td>Oxygen reduction reaction</td>
</tr>
<tr>
<td>OSHA</td>
<td>U.S. Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>OTM</td>
<td>Oxygen transport membrane</td>
</tr>
<tr>
<td>ΔP</td>
<td>Pressure drop, pressure change</td>
</tr>
<tr>
<td>P</td>
<td>Phosphorus</td>
</tr>
<tr>
<td>Pa</td>
<td>Pascal(s)</td>
</tr>
<tr>
<td>PA</td>
<td>Phenylacetylene</td>
</tr>
<tr>
<td>PADD</td>
<td>Petroleum Administration for Defense District</td>
</tr>
<tr>
<td>PAFC</td>
<td>Phosphoric acid fuel cell</td>
</tr>
<tr>
<td>PANI</td>
<td>Polyaniline</td>
</tr>
<tr>
<td>PAS</td>
<td>Photoactive semiconductor</td>
</tr>
<tr>
<td>PAW</td>
<td>Projector augmented wave</td>
</tr>
<tr>
<td>Pb</td>
<td>Lead</td>
</tr>
<tr>
<td>PbA</td>
<td>Lead acid</td>
</tr>
<tr>
<td>PBI</td>
<td>Polybenzimidazole</td>
</tr>
<tr>
<td>PbO</td>
<td>Lead oxide</td>
</tr>
<tr>
<td>P-C</td>
<td>Pressure-composition</td>
</tr>
<tr>
<td>PC</td>
<td>Polycarbonate</td>
</tr>
<tr>
<td>PC</td>
<td>Personal computer</td>
</tr>
<tr>
<td>Pc</td>
<td>Phthalocyanines (e.g., MoPc, FePc)</td>
</tr>
<tr>
<td>PCHD</td>
<td>poly(cyclohexadiene)</td>
</tr>
<tr>
<td>PCI</td>
<td>Pressure-composition isotherm</td>
</tr>
<tr>
<td>PCM</td>
<td>Power control module</td>
</tr>
<tr>
<td>PCR</td>
<td>Polymerase chain reaction</td>
</tr>
<tr>
<td>PCS</td>
<td>Power conditioning system</td>
</tr>
<tr>
<td>PCS</td>
<td>Plasma converter system</td>
</tr>
<tr>
<td>PCT, P-C-T</td>
<td>Pressure concentration temperature</td>
</tr>
<tr>
<td>Pd</td>
<td>Palladium</td>
</tr>
<tr>
<td>PDA</td>
<td>Phenylidiacetylene</td>
</tr>
<tr>
<td>Pd-CR</td>
<td>Palladium-based chemical resistor</td>
</tr>
<tr>
<td>Pd-Cu</td>
<td>Palladium-copper</td>
</tr>
<tr>
<td>Pd-MIS</td>
<td>Palladium-based metal-insulator-semiconductor</td>
</tr>
<tr>
<td>PDA</td>
<td>Polyethyletherketon</td>
</tr>
<tr>
<td>PEC</td>
<td>Photoelectrochemical</td>
</tr>
<tr>
<td>PECH</td>
<td>Polyepichlorhydrin</td>
</tr>
<tr>
<td>PECVD</td>
<td>Plasma-enhanced chemical vapor deposition</td>
</tr>
<tr>
<td>PEEK</td>
<td>Polyether ether ether ketone</td>
</tr>
<tr>
<td>PEFC</td>
<td>Polymer electrolyte fuel cell</td>
</tr>
<tr>
<td>PEFC</td>
<td>Proton exchange fuel cell</td>
</tr>
<tr>
<td>PEI</td>
<td>Polyetherimide</td>
</tr>
<tr>
<td>PEK</td>
<td>Poly (ether ketone ketone)</td>
</tr>
<tr>
<td>PEM</td>
<td>Polymer electrolyte membrane</td>
</tr>
</tbody>
</table>
XI. Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEM</td>
<td>Proton exchange membrane</td>
</tr>
<tr>
<td>PEMFC</td>
<td>Polymer electrolyte membrane fuel cell</td>
</tr>
<tr>
<td>PES</td>
<td>Polyether sulfone</td>
</tr>
<tr>
<td>PET</td>
<td>Polyethylene terephthalate</td>
</tr>
<tr>
<td>PFA</td>
<td>Perfluoroalkoxy (a type of fluoropolymer)</td>
</tr>
<tr>
<td>PFC</td>
<td>Polymer electrolyte membrane fuel cell</td>
</tr>
<tr>
<td>PFCT</td>
<td>Porvair Fuel Cell Technology, Inc.</td>
</tr>
<tr>
<td>PFD</td>
<td>Process flow diagram</td>
</tr>
<tr>
<td>PFGSE</td>
<td>Pulse field gradient spin echo</td>
</tr>
<tr>
<td>PFGSE NMR</td>
<td>Pulsed field gradient spin echo nuclear magnetic resonance</td>
</tr>
<tr>
<td>PFSA</td>
<td>Perfluorinated sulfonic acid</td>
</tr>
<tr>
<td>PFSI</td>
<td>Perfluorosulfonate ionomer</td>
</tr>
<tr>
<td>PGAA</td>
<td>Prompt gamma activation analysis</td>
</tr>
<tr>
<td>PGAA</td>
<td>Prompt-gamma activation analysis</td>
</tr>
<tr>
<td>PGM</td>
<td>Platinum group metal</td>
</tr>
<tr>
<td>PHP</td>
<td>Para-hydrogen induced polarization</td>
</tr>
<tr>
<td>PI</td>
<td>Principal investigator</td>
</tr>
<tr>
<td>PILs</td>
<td>Protonic ionic liquids</td>
</tr>
<tr>
<td>Pl</td>
<td>Platinum</td>
</tr>
<tr>
<td>pKₐ</td>
<td>Acid dissociation constant</td>
</tr>
<tr>
<td>PLC</td>
<td>Programmable logic controller</td>
</tr>
<tr>
<td>PM</td>
<td>Precious metal, such as platinum; peroxide mitigation</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>Particulate matter with diameters of 10 micrometers or less</td>
</tr>
<tr>
<td>P/M</td>
<td>Powder metallurgy</td>
</tr>
<tr>
<td>PMF</td>
<td>Potential mean free energy</td>
</tr>
<tr>
<td>PMG</td>
<td>Glycidyl methacrylate-type copolymer</td>
</tr>
<tr>
<td>PNNL</td>
<td>Pacific Northwest National Laboratory</td>
</tr>
<tr>
<td>POC</td>
<td>Proof of concept</td>
</tr>
<tr>
<td>POSS</td>
<td>Polyhedral oligomeric silsesquioxane</td>
</tr>
<tr>
<td>POX</td>
<td>Partial oxidation</td>
</tr>
<tr>
<td>ppb</td>
<td>Parts per billion</td>
</tr>
<tr>
<td>ppbv</td>
<td>Parts per billion by volume</td>
</tr>
<tr>
<td>PPI</td>
<td>Pore(s) per inch</td>
</tr>
<tr>
<td>ppm, PPM</td>
<td>Parts per million</td>
</tr>
<tr>
<td>ppmv</td>
<td>Parts per million by volume</td>
</tr>
<tr>
<td>ppmw</td>
<td>Parts per million by weight</td>
</tr>
<tr>
<td>PPO</td>
<td>Phenyl phosphate oxide</td>
</tr>
<tr>
<td>PPS</td>
<td>Polyphenylenesulfide</td>
</tr>
<tr>
<td>PrOx</td>
<td>Preferential oxidation</td>
</tr>
<tr>
<td>PSA</td>
<td>Pressure swing adsorption, adsorber</td>
</tr>
<tr>
<td>PSAT</td>
<td>Vehicle simulation software package developed at Argonne National Laboratory - Power-train System Analysis Toolkit</td>
</tr>
<tr>
<td>PSD</td>
<td>Particle size distribution, pore size distribution</td>
</tr>
<tr>
<td>psi, PSI</td>
<td>Pound(s) per square inch</td>
</tr>
<tr>
<td>psia</td>
<td>Pound(s) per square inch absolute</td>
</tr>
<tr>
<td>psid</td>
<td>Pound(s) per square inch differential</td>
</tr>
<tr>
<td>psig</td>
<td>Pound(s) per square inch gauge</td>
</tr>
<tr>
<td>PSM</td>
<td>Protic salt membrane</td>
</tr>
<tr>
<td>PSU</td>
<td>Pennsylvania State University</td>
</tr>
<tr>
<td>PSU OPP</td>
<td>Pennsylvania State University, Office of Physical Plant</td>
</tr>
<tr>
<td>PSU PTI</td>
<td>Pennsylvania State University, Pennsylvania Transportation Institute</td>
</tr>
<tr>
<td>Pt</td>
<td>Platinum</td>
</tr>
<tr>
<td>Pt-MM</td>
<td>Platinum mixed metal</td>
</tr>
<tr>
<td>P-T</td>
<td>Pressure-temperature</td>
</tr>
<tr>
<td>PTA</td>
<td>Phosphotungstic acid</td>
</tr>
<tr>
<td>Pt/C</td>
<td>Platinum on carbon</td>
</tr>
<tr>
<td>Pt₃Co</td>
<td>Platinum-cobalt alloy</td>
</tr>
<tr>
<td>Pt₃Fe</td>
<td>Platinum-iron alloy</td>
</tr>
<tr>
<td>PTFE</td>
<td>Teflon® - poly-tetrafluoroethylene</td>
</tr>
<tr>
<td>Pt-FePO</td>
<td>Platinum iron phosphate</td>
</tr>
<tr>
<td>Pt-MM</td>
<td>Platinum group mixed metal</td>
</tr>
<tr>
<td>PTM</td>
<td>Proton transport membrane</td>
</tr>
<tr>
<td>PtML</td>
<td>Platinum monolayer</td>
</tr>
<tr>
<td>Pt₃Ni</td>
<td>Platinum-nickel alloy</td>
</tr>
<tr>
<td>PTO</td>
<td>Power take-off</td>
</tr>
<tr>
<td>PtO₂</td>
<td>Platinum dioxide</td>
</tr>
<tr>
<td>Pt-TaPO</td>
<td>Platinum tantalum phosphate</td>
</tr>
<tr>
<td>PTW</td>
<td>Pump-to-wheel</td>
</tr>
<tr>
<td>PUC</td>
<td>Public Utility Commission</td>
</tr>
<tr>
<td>PV</td>
<td>Photovoltaic</td>
</tr>
<tr>
<td>PVC</td>
<td>Polyvinyl chloride</td>
</tr>
<tr>
<td>PVD</td>
<td>Physical vapor deposition</td>
</tr>
<tr>
<td>PVDF</td>
<td>Polyvinylidene fluoride</td>
</tr>
<tr>
<td>PVP</td>
<td>Polyvinylpyrrolidone</td>
</tr>
<tr>
<td>PVT, P-V-T</td>
<td>Pressure-Volume-Temperature</td>
</tr>
<tr>
<td>PW91</td>
<td>Perdew-Wang 91</td>
</tr>
<tr>
<td>Q₁, Q₂, Q₃, Q₄</td>
<td>Quarters of the fiscal year</td>
</tr>
<tr>
<td>QC</td>
<td>Quality control</td>
</tr>
<tr>
<td>R</td>
<td>Universal or ideal gas constant, 8.314472 J · K⁻¹ · mol⁻¹</td>
</tr>
<tr>
<td>Raman</td>
<td>a spectroscopic technique</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td>RBS</td>
<td>Rutherford back scattering</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and development</td>
</tr>
<tr>
<td>RD&amp;D, R,D&amp;D</td>
<td>Research, development &amp; demonstration</td>
</tr>
<tr>
<td>RDE</td>
<td>Rotating disk electrode</td>
</tr>
<tr>
<td>Re</td>
<td>Rhenium</td>
</tr>
<tr>
<td>REWP</td>
<td>Renewable Energy Working Party</td>
</tr>
<tr>
<td>RF</td>
<td>Generic fluoroalkyl group</td>
</tr>
<tr>
<td>RF</td>
<td>Radio frequency</td>
</tr>
<tr>
<td>RFP</td>
<td>Request for proposals</td>
</tr>
<tr>
<td>RGA</td>
<td>Residual gas analyzer</td>
</tr>
<tr>
<td>RH</td>
<td>Relative humidity</td>
</tr>
<tr>
<td>Rh</td>
<td>Rhodium</td>
</tr>
<tr>
<td>RHE</td>
<td>Reference hydrogen electrode; reversible hydrogen electrode</td>
</tr>
<tr>
<td>( \rho_a )</td>
<td>Apparent density of activated carbon</td>
</tr>
<tr>
<td>( \rho_{ad,H_2} )</td>
<td>Adsorbate hydrogen density in micropores</td>
</tr>
<tr>
<td>RNA</td>
<td>Ribo nucleic acid</td>
</tr>
<tr>
<td>RPI</td>
<td>Rensselaer Polytechnic Institute</td>
</tr>
<tr>
<td>rpm</td>
<td>Revolution(s) per minute</td>
</tr>
<tr>
<td>RRDE</td>
<td>Rotating ring disc electrode</td>
</tr>
<tr>
<td>RT</td>
<td>Room temperature</td>
</tr>
<tr>
<td>Ru</td>
<td>Ruthenium</td>
</tr>
<tr>
<td>s</td>
<td>Second(s)</td>
</tr>
<tr>
<td>S</td>
<td>Siemen(s)</td>
</tr>
<tr>
<td>S</td>
<td>Sulfur</td>
</tr>
<tr>
<td>SA</td>
<td>Surface area</td>
</tr>
<tr>
<td>SAE</td>
<td>Society of Automotive Engineers</td>
</tr>
<tr>
<td>SAM</td>
<td>Scanning Auger microscopy</td>
</tr>
<tr>
<td>SAXS</td>
<td>Small angle x-ray scattering analysis</td>
</tr>
<tr>
<td>( S_{\text{BET}} )</td>
<td>BET specific surface area</td>
</tr>
<tr>
<td>SBCR</td>
<td>Slurry bubble column reactor</td>
</tr>
<tr>
<td>SBH</td>
<td>Sodium borohydride</td>
</tr>
<tr>
<td>SBIR</td>
<td>Small Business Innovative Research</td>
</tr>
<tr>
<td>SBU</td>
<td>Secondary building unit</td>
</tr>
<tr>
<td>Sc</td>
<td>Scandium</td>
</tr>
<tr>
<td>S/C</td>
<td>Steam to carbon ratio</td>
</tr>
<tr>
<td>SCD</td>
<td>Spinneret-to-collector</td>
</tr>
<tr>
<td>sccm, SCCM</td>
<td>Standard cubic centimeter(s) per minute</td>
</tr>
<tr>
<td>SCE</td>
<td>Southern California Edison</td>
</tr>
<tr>
<td>SCE</td>
<td>Saturated calomel electrode</td>
</tr>
<tr>
<td>SCF, scf</td>
<td>Standard cubic feet</td>
</tr>
<tr>
<td>scfd</td>
<td>Standard cubic feet per day</td>
</tr>
<tr>
<td>SCFH, scfh</td>
<td>Standard cubic feet per hour</td>
</tr>
<tr>
<td>SCFM</td>
<td>Standard cubic feet per minute</td>
</tr>
<tr>
<td>SCPO</td>
<td>Staged catalytic partial oxidation</td>
</tr>
<tr>
<td>SCR</td>
<td>Selective catalytic reduction</td>
</tr>
<tr>
<td>S/cm</td>
<td>Siemen(s) per centimeter</td>
</tr>
<tr>
<td>SD</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>SDAPP</td>
<td>Sulfonated Diels-Alder polyphenylene</td>
</tr>
<tr>
<td>SDAPPe</td>
<td>Sulfonated Diels-Alder polyphenylene ether</td>
</tr>
<tr>
<td>SDO</td>
<td>Standards Development Organization</td>
</tr>
<tr>
<td>SDT</td>
<td>Simultaneous differential scanning calorimeter and thermalgravimetric analyzer</td>
</tr>
<tr>
<td>Se</td>
<td>Selenium</td>
</tr>
<tr>
<td>sec</td>
<td>Second(s)</td>
</tr>
<tr>
<td>SECA</td>
<td>Solid State Energy Conversion Alliance</td>
</tr>
<tr>
<td>SEM</td>
<td>Scanning electron microscopy</td>
</tr>
<tr>
<td>SEM</td>
<td>Secondary electron microscopy</td>
</tr>
<tr>
<td>SEMaC</td>
<td>Smart Energy Management Controller</td>
</tr>
<tr>
<td>SEOS</td>
<td>Simple equation of state</td>
</tr>
<tr>
<td>SERC</td>
<td>Schatz Energy Research Center</td>
</tr>
<tr>
<td>SF(_6)</td>
<td>Sulfur hexafluoride</td>
</tr>
<tr>
<td>SFA</td>
<td>Sulfonic acid</td>
</tr>
<tr>
<td>SHE</td>
<td>Standard hydrogen electrode</td>
</tr>
<tr>
<td>Si</td>
<td>Silicon</td>
</tr>
<tr>
<td>S-I</td>
<td>Sulfur-iodine</td>
</tr>
<tr>
<td>SiC</td>
<td>Silicon carbide</td>
</tr>
<tr>
<td>SIMS</td>
<td>Secondary ion emission spectroscopy</td>
</tr>
<tr>
<td>SiO(_2)</td>
<td>Silicon dioxide</td>
</tr>
<tr>
<td>SLPM, SLM, sL/min</td>
<td>Standard liter(s) per minute</td>
</tr>
<tr>
<td>SMAE</td>
<td>Solid membrane alkaline electrolyzer</td>
</tr>
<tr>
<td>SMC</td>
<td>Sheet-molding-compound</td>
</tr>
<tr>
<td>SME</td>
<td>Mercury sulfate electrode</td>
</tr>
<tr>
<td>S(_{\text{min}})</td>
<td>Minimum surface area</td>
</tr>
<tr>
<td>SMR</td>
<td>Steam methane reformer; steam methane reforming</td>
</tr>
<tr>
<td>Sn</td>
<td>Tin</td>
</tr>
<tr>
<td>SNG</td>
<td>Substitute natural gas</td>
</tr>
<tr>
<td>SNL</td>
<td>Sandia National Laboratories</td>
</tr>
<tr>
<td>SNLL</td>
<td>Sandia National Laboratory Livermore</td>
</tr>
<tr>
<td>SnO(_2)</td>
<td>Tin oxide</td>
</tr>
<tr>
<td>SnO(_2)</td>
<td>Tin oxide</td>
</tr>
<tr>
<td>SO(_2)</td>
<td>Sulfur dioxide</td>
</tr>
<tr>
<td>SO(_3)</td>
<td>Sulfur trioxide</td>
</tr>
<tr>
<td>SOC</td>
<td>State of charge</td>
</tr>
<tr>
<td>SOEC</td>
<td>Solid oxide electrolysis cell; solid oxide electrolyzer cell</td>
</tr>
<tr>
<td>SOFC</td>
<td>Solid oxide fuel cell</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>SOFEC</td>
<td>Solid oxide fuel-fed electrolysis cell</td>
</tr>
<tr>
<td>SOM</td>
<td>Solid-oxide oxygen-ion-conducting membrane</td>
</tr>
<tr>
<td>SOO</td>
<td>Statement of Objectives</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard operating procedure</td>
</tr>
<tr>
<td>SORFC</td>
<td>Solid oxide regenerative fuel cell</td>
</tr>
<tr>
<td>SOx</td>
<td>Oxides of sulfur</td>
</tr>
<tr>
<td>SPE</td>
<td>Solid phase epitaxial</td>
</tr>
<tr>
<td>SPEKK</td>
<td>Sulfonated polyether(ether ketone) ketone</td>
</tr>
<tr>
<td>sPEEK</td>
<td>Sulfonated poly(ether ether ketone)</td>
</tr>
<tr>
<td>SPEX</td>
<td>Type of milling machine</td>
</tr>
<tr>
<td>SPR</td>
<td>Solid particle receiver</td>
</tr>
<tr>
<td>sq. in.</td>
<td>Square inch(es)</td>
</tr>
<tr>
<td>Sr</td>
<td>Strontium</td>
</tr>
<tr>
<td>SR</td>
<td>Steam reformer; steam reforming</td>
</tr>
<tr>
<td>SRM</td>
<td>Steam reforming</td>
</tr>
<tr>
<td>SRNL</td>
<td>Savannah River National Laboratory</td>
</tr>
<tr>
<td>SS</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>SSA</td>
<td>Specific surface area</td>
</tr>
<tr>
<td>SSM</td>
<td>Stress strain microprobe</td>
</tr>
<tr>
<td>SSR™</td>
<td>Stackable Structural Reactor</td>
</tr>
<tr>
<td>SSRL</td>
<td>Stanford Synchrotron Radiation Laboratory</td>
</tr>
<tr>
<td>STA</td>
<td>Silicotungstic acid</td>
</tr>
<tr>
<td>STEM</td>
<td>Scanning transmission electron microscopy</td>
</tr>
<tr>
<td>STH</td>
<td>Solar-to-hydrogen</td>
</tr>
<tr>
<td>STM</td>
<td>Scanning tunneling electron microscopy</td>
</tr>
<tr>
<td>STP</td>
<td>Standard temperature and pressure</td>
</tr>
<tr>
<td>STTR</td>
<td>Small Business Technology Transfer</td>
</tr>
<tr>
<td>SUNY</td>
<td>State University of New York</td>
</tr>
<tr>
<td>SV</td>
<td>Space velocity</td>
</tr>
<tr>
<td>SWCNT</td>
<td>Single-walled carbon nanotube</td>
</tr>
<tr>
<td>SWNH</td>
<td>Single-walled nanohorn</td>
</tr>
<tr>
<td>SWNT</td>
<td>Single-wall nanotube</td>
</tr>
<tr>
<td>SwRI</td>
<td>Southwest Research Institute</td>
</tr>
<tr>
<td>T</td>
<td>Temperature</td>
</tr>
<tr>
<td>T</td>
<td>Ton</td>
</tr>
<tr>
<td>t</td>
<td>Time</td>
</tr>
<tr>
<td>Ta</td>
<td>Tantalum</td>
</tr>
<tr>
<td>TAG</td>
<td>Technical Advisory Group</td>
</tr>
<tr>
<td>TaPO</td>
<td>Tantalum phosphate</td>
</tr>
<tr>
<td>TBA₂B₁₂H₁₂</td>
<td>Tetra-(n)-butylammonium dodecahydrododecaborate</td>
</tr>
<tr>
<td>TBA-PF₆</td>
<td>Tetra-(n)-butylammonium hexafluorophosphate</td>
</tr>
<tr>
<td>TBD</td>
<td>To be determined</td>
</tr>
<tr>
<td>TBX</td>
<td>Turboexpander</td>
</tr>
<tr>
<td>TC</td>
<td>Thermocouple</td>
</tr>
<tr>
<td>TC</td>
<td>Thermochemical</td>
</tr>
<tr>
<td>TCD</td>
<td>Thermal conductivity detector</td>
</tr>
<tr>
<td>TDS</td>
<td>Transitional demand scenario</td>
</tr>
<tr>
<td>Te</td>
<td>Tellurium</td>
</tr>
<tr>
<td>TEA₂B₁₂H₁₂</td>
<td>Triethylammonium dodecahydrododecaborate</td>
</tr>
<tr>
<td>TEAB</td>
<td>Tetraethyl ammonium borohydride</td>
</tr>
<tr>
<td>TEAH</td>
<td>Tetraethylammonium hydroxide</td>
</tr>
<tr>
<td>TEAMS</td>
<td>Tetraethylammonium methane sulfonic</td>
</tr>
<tr>
<td>TEM</td>
<td>Transmission electron microscopy</td>
</tr>
<tr>
<td>TESI</td>
<td>Teledyne Energy System Inc.</td>
</tr>
<tr>
<td>TFMSA</td>
<td>Trifluoromethane sulfonic acid</td>
</tr>
<tr>
<td>TFVE</td>
<td>Trifluorovinyl ether</td>
</tr>
<tr>
<td>tf-Si</td>
<td>Thin film silicon</td>
</tr>
<tr>
<td>Tg</td>
<td>Glass transition temperature</td>
</tr>
<tr>
<td>TG</td>
<td>Thermogravimetric</td>
</tr>
<tr>
<td>TGA</td>
<td>Thermal gravimetric analysis; thermogravimetric analysis; thermal gravimetric analyzer</td>
</tr>
<tr>
<td>TGC</td>
<td>Tail gas combustor</td>
</tr>
<tr>
<td>THC</td>
<td>Total hydrocarbons</td>
</tr>
<tr>
<td>THF</td>
<td>Tetrahydrofuran</td>
</tr>
<tr>
<td>Ti</td>
<td>Titanium</td>
</tr>
<tr>
<td>TiCl₃</td>
<td>Titanium trichloride</td>
</tr>
<tr>
<td>TiF₃</td>
<td>Titanium trifluoride</td>
</tr>
<tr>
<td>TiH₂</td>
<td>Titanium hydride</td>
</tr>
<tr>
<td>TiO₂</td>
<td>Titanium dioxide (anatase)</td>
</tr>
<tr>
<td>Tla</td>
<td>Truncated light-harvesting chlorophyll antenna</td>
</tr>
<tr>
<td>tla₁</td>
<td>Mutant of the Tla₁ gene (GenBank Assession No. AF534570)</td>
</tr>
<tr>
<td>tlaX</td>
<td>Mutant of unknown gene with a truncated light-harvesting chlorophyll antenna (GenBank Assession No. AF534571)</td>
</tr>
<tr>
<td>Tl</td>
<td>Tons per day</td>
</tr>
<tr>
<td>TM</td>
<td>Transition metal</td>
</tr>
<tr>
<td>TMB</td>
<td>Trimethylborate</td>
</tr>
<tr>
<td>ToF-SIMS</td>
<td>Time-of-flight secondary ion spectroscopy</td>
</tr>
<tr>
<td>TPD</td>
<td>Thermally programmed desorption; Temperature-programmed desorption</td>
</tr>
<tr>
<td>TPO</td>
<td>Temperature-programmed oxidation</td>
</tr>
<tr>
<td>TPP</td>
<td>Tetraphenyl porphyrin</td>
</tr>
<tr>
<td>TPR</td>
<td>Temperature-programmed reduction</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>tr. oz.</td>
<td>Troy ounce</td>
</tr>
<tr>
<td>TSSER</td>
<td>Thermal swing sorption enhanced reaction</td>
</tr>
<tr>
<td>UC</td>
<td>University of California</td>
</tr>
<tr>
<td>UCI</td>
<td>University of California, Irvine</td>
</tr>
<tr>
<td>UCLA</td>
<td>University of California, Los Angeles</td>
</tr>
<tr>
<td>UCONN</td>
<td>University of Connecticut</td>
</tr>
<tr>
<td>UCSB</td>
<td>University of California, Santa Barbara</td>
</tr>
<tr>
<td>UDDS</td>
<td>Urban Dynamometer Driving Schedule</td>
</tr>
<tr>
<td>UH</td>
<td>University of Hawaii</td>
</tr>
<tr>
<td>UHP</td>
<td>Ultra-high purity</td>
</tr>
<tr>
<td>UHV</td>
<td>Ultra-high vacuum</td>
</tr>
<tr>
<td>UIUC</td>
<td>University of Illinois, Urbana-Champaign</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters Laboratory</td>
</tr>
<tr>
<td>ULSD</td>
<td>Ultra-low sulfur diesel</td>
</tr>
<tr>
<td>um</td>
<td>Micrometer(s)</td>
</tr>
<tr>
<td>UNC</td>
<td>University of North Carolina</td>
</tr>
<tr>
<td>UN/ECE</td>
<td>United Nations/Economic Commission for Europe</td>
</tr>
<tr>
<td>UNLV</td>
<td>University of Nevada Las Vegas</td>
</tr>
<tr>
<td>UNLVRF</td>
<td>UNLV Research Foundation</td>
</tr>
<tr>
<td>UNM</td>
<td>University of New Mexico</td>
</tr>
<tr>
<td>UNR</td>
<td>University of Nevada, Reno</td>
</tr>
<tr>
<td>UPS</td>
<td>Ultraviolet photoelectron spectroscopy</td>
</tr>
<tr>
<td>US06</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>U.S.</td>
<td>United States</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>USC</td>
<td>University of South Carolina</td>
</tr>
<tr>
<td>USC</td>
<td>University of Southern California</td>
</tr>
<tr>
<td>USCAR</td>
<td>U.S. Cooperative Automotive Research</td>
</tr>
<tr>
<td>USFCC</td>
<td>United States Fuel Cell Council</td>
</tr>
<tr>
<td>USM</td>
<td>University of Southern Mississippi</td>
</tr>
<tr>
<td>USPP</td>
<td>Ultrasoft pseudopotentials</td>
</tr>
<tr>
<td>UT</td>
<td>University of Toledo</td>
</tr>
<tr>
<td>UTC, UTC FC</td>
<td>United Technologies Corporation Fuel Cells</td>
</tr>
<tr>
<td>UTC</td>
<td>University of Tennessee, Chattanooga</td>
</tr>
<tr>
<td>UTR</td>
<td>Untranslated region</td>
</tr>
<tr>
<td>UTRC</td>
<td>United Technologies Research Center</td>
</tr>
<tr>
<td>UV</td>
<td>Ultraviolet</td>
</tr>
<tr>
<td>UV-vis</td>
<td>Ultraviolet-Visual</td>
</tr>
<tr>
<td>UW</td>
<td>University of Washington</td>
</tr>
<tr>
<td>V</td>
<td>Vanadium</td>
</tr>
<tr>
<td>VAC</td>
<td>Volts alternating current</td>
</tr>
<tr>
<td>VASP</td>
<td>Vienna Ab-initio Simulation Package</td>
</tr>
<tr>
<td>VaTech</td>
<td>Virginia Polytechnic Institute and State University</td>
</tr>
<tr>
<td>VC</td>
<td>Vulcan carbon</td>
</tr>
<tr>
<td>VDC</td>
<td>Volts direct current</td>
</tr>
<tr>
<td>vdW</td>
<td>van der Waals</td>
</tr>
<tr>
<td>V(H2)</td>
<td>Volumetric hydrogen adsorption capacity</td>
</tr>
<tr>
<td>VHTR</td>
<td>very high temperature gas-cooled nuclear reactor</td>
</tr>
<tr>
<td>VHTS</td>
<td>Virtual high-throughput screening</td>
</tr>
<tr>
<td>V-I</td>
<td>Voltage – current</td>
</tr>
<tr>
<td>VIM/VAR</td>
<td>Vacuum induction melting/vacuum arc remelting</td>
</tr>
<tr>
<td>VIR</td>
<td>Voltage - current - resistance</td>
</tr>
<tr>
<td>VMT</td>
<td>Vehicle miles travelled</td>
</tr>
<tr>
<td>VNT</td>
<td>Variable nozzle turbine</td>
</tr>
<tr>
<td>VOC</td>
<td>Volatile organic compounds; Voltage open circuit</td>
</tr>
<tr>
<td>vol</td>
<td>Volume</td>
</tr>
<tr>
<td>vol%</td>
<td>Volume percent</td>
</tr>
<tr>
<td>VT</td>
<td>Virginia Tech</td>
</tr>
<tr>
<td>VTA</td>
<td>Valley Transportation Authority</td>
</tr>
<tr>
<td>VTGR</td>
<td>Very high temperature gas reactor</td>
</tr>
<tr>
<td>W</td>
<td>Tungsten</td>
</tr>
<tr>
<td>W</td>
<td>Watt(s)</td>
</tr>
<tr>
<td>WAXD</td>
<td>Wide-angle x-ray diffraction</td>
</tr>
<tr>
<td>WBS</td>
<td>Work breakdown schedule</td>
</tr>
<tr>
<td>W/cm²</td>
<td>Watt(s) per square centimeter</td>
</tr>
<tr>
<td>We</td>
<td>Watt(s) electric</td>
</tr>
<tr>
<td>WGS</td>
<td>Water-gas-shift</td>
</tr>
<tr>
<td>WGS-MR</td>
<td>Water-gas-shift membrane reactor</td>
</tr>
<tr>
<td>Wh</td>
<td>Watt-hour(s)</td>
</tr>
<tr>
<td>W-h/kg</td>
<td>Watt-hour(s) per kilogram</td>
</tr>
<tr>
<td>W-h/L, Wh/liter</td>
<td>Watt-hour(s) per liter</td>
</tr>
<tr>
<td>W/HSV</td>
<td>Weight hourly space velocity</td>
</tr>
<tr>
<td>W/kg</td>
<td>Watt(s) per kilogram</td>
</tr>
<tr>
<td>W/L, W/l</td>
<td>Watt(s) per liter</td>
</tr>
<tr>
<td>W/m-K, W/m.K</td>
<td>Watt(s) per meter-Kelvin (unit of thermal conductivity)</td>
</tr>
<tr>
<td>WO3</td>
<td>Tungsten trioxide</td>
</tr>
<tr>
<td>WP.29</td>
<td>World Harmonization of Vehicle Regulations</td>
</tr>
<tr>
<td>Wt</td>
<td>Watt(s) thermal</td>
</tr>
<tr>
<td>wt</td>
<td>Weight</td>
</tr>
</tbody>
</table>
**XI. Acronyms and Abbreviations**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>wt%, wt.%</td>
<td></td>
<td>Weight percent (percent by weight)</td>
</tr>
<tr>
<td>WTP</td>
<td></td>
<td>Well-to-pump</td>
</tr>
<tr>
<td>WTW</td>
<td></td>
<td>Well-to-wheel</td>
</tr>
<tr>
<td>X-</td>
<td></td>
<td>An anionic ligand such as chloride</td>
</tr>
<tr>
<td>XANES</td>
<td></td>
<td>X-ray absorption near-edge spectroscopy</td>
</tr>
<tr>
<td>XAS</td>
<td></td>
<td>X-ray absorption spectroscopy</td>
</tr>
<tr>
<td>XML</td>
<td></td>
<td>Extensible markup language</td>
</tr>
<tr>
<td>XPS</td>
<td></td>
<td>X-ray photoelectron spectroscopy</td>
</tr>
<tr>
<td>XRD</td>
<td></td>
<td>X-ray diffraction</td>
</tr>
<tr>
<td>XRF</td>
<td></td>
<td>X-ray fluorescence</td>
</tr>
<tr>
<td>Y</td>
<td></td>
<td>Yttrium</td>
</tr>
<tr>
<td>yr, YR</td>
<td></td>
<td>Year</td>
</tr>
<tr>
<td>YSZ</td>
<td></td>
<td>Yttria-stablized zirconia</td>
</tr>
<tr>
<td>ZEV</td>
<td></td>
<td>Zero emission vehicle</td>
</tr>
<tr>
<td>Zn</td>
<td></td>
<td>Zinc</td>
</tr>
<tr>
<td>ZnO</td>
<td></td>
<td>Zinc oxide</td>
</tr>
<tr>
<td>zpp</td>
<td></td>
<td>Zirconium phenyl phosphonate</td>
</tr>
<tr>
<td>Zr</td>
<td></td>
<td>Zirconium</td>
</tr>
<tr>
<td>ZrO₂</td>
<td></td>
<td>Zirconium dioxide</td>
</tr>
</tbody>
</table>