Acronyms, Abbreviations, and Definitions

(AD)Fe-N-C	atomically dispersed iron-nitrogen-carbon (catalyst)
(CM+PANI)-Fe(Zn)-C	cyanimide- and polyaniline-derived iron-(zinc)-nitrogen-carbon
(Fe,Zn)-ZIF	zinc and iron zeolitic imidazolate framework
^{1}H NMR	proton (^{1}H) nuclear magnetic resonance
2DM	two-dimensional manufacturing
2PB	two-phase boundary
30k SW	30,000 square wave
3-D	three dimensional
3D	three dimensional
3PB	three-phase boundary
a	symmetry factor
AB	acetylene black
ABS	American Bureau of Shipping
AC	activated carbon
ACI	ACI Services, Inc.
AEM	alkaline exchange membrane; anion exchange membrane
AEMEl	alkaline exchange membrane electrolyzer
AEMFC	anion exchange membrane fuel cell
AFC	alkaline fuel cell
AFCB	American Fuel Cell Bus
AFDC	Alternative Fuels Data Center
AFM	atomic force microscopy
AFV	alternative fuel vehicle
AHJ	authority having jurisdiction
AHMF	Advanced Hydrogen Mobile Fueler
AIChE	American Institute of Chemical Engineers
ALD	atomic layer deposition
AMFC	alkaline membrane fuel cell
AMR	active magnetic regenerator; Annual Merit Review
AMRL	active magnetic regenerative liquefier
ANL	Argonne National Laboratory
ANSI	American National Standards Institute
AOP	Annual Operating Plan
API	application program interface
ARPA-E	Advanced Research Projects Agency–Energy
ASR	area specific resistance
AST	accelerated stability test; accelerated stress test
at %	atomic percent
ATM-PP	benzyltrimethylammonium functionalized Diels-Alder poly(phenylene)
ATO	antimony-doped-tin-oxide
AVT	A. V. Tchouvelev & Associates, Inc.
AWSM	advanced water splitting materials
B	magnetic induction (T)
b	relative humidity dependence; Tafel slope
BCF	a new triple conducting O_2 electrode with composition protection
BCFCo0.2	$BaCe_{0.4}Fe_{0.4}Co_{0.2}O_{3-\delta}$
BCFZY0.1	$BaCo_{0.4}Fe_{0.4}Zr_{0.1}Y_{0.1}O_{3-\delta}$
BCZY63	$BaCe_{0.6}Zr_{0.3}Y_{0.1}O_{3-\delta}$
BCZYS10	a new electrolyte with composition protection
BCZYYb	$BaCe_{0.7}Zr_{0.1}Y_{0.1}Yb_{0.1}O_{3-\delta}$
BEB	battery electric bus
BET	Brunauer-Emmett-Teller
BJH	Barrett, Joyner, and Halenda adsorption
BN	boron nitride
BN-TiN	boron nitride–titanium nitride
BOE	beginning of experiment

BoL	beginning of life
BOP	balance of plant
BOT	beginning of test
BP	budget period
BP	Black Pearls (type of a high-surface-area carbon)
BPA	bipolar plate assembly
BP-Ar(Fx)	perfluoroalkylsulfonate polymer(s)
BPM	bipolar membrane
BPN	alkyl ammonium functionalized poly(biphenylene)s; quaternized poly(biphenylene)
BPP	bipolar plate
BTMAOH	benzyltrimethyl ammonium hydroxide
BU	Boston University
BYZ	barium yttrium zirconate
BZCYYb	$BaZr_{0.7}Ce_{0.1}Y_{0.1}Yb_{0.1}O_{3-\delta}$; cerium and ytterbium-doped barium yttrium zirconate
C5	five-carbon sugar (hemicellulose)
C6	six-carbon sugar (cellulose)
CAE	cathodic arc evaporation
CaFCP	California Fuel Cell Partnership
CAN	controller area network
CAN 2.0A	Controller Area Network Version 2.0A
CAN 2.0B	Controller Area Network Version 2.0B
CARB	California Air Resources Board
CBP	consolidated bioprocessing
CcH_2	cryo-compressed hydrogen
CCL	cathode-catalyst layer
CCM	catalyst coated membrane
CCPM3	California Climate Policy Modeling
CDO	code development organization
CDP	composite data product
CEC	California Energy Commission
CF	carbon fiber
CFD	computational fluid dynamics
CH	chemical hydrogen storage
cH_2	compressed hydrogen
CHE	computational hydrogen electrode
CHS	Center for Hydrogen Safety
CL	catalyst layer
CMU	Carnegie Mellon University
CMVSS	Canadian Motor Vehicle Safety Standard
CNF	carbon nanofibers
CNG	compressed natural gas
Co	cobalt
CO_2	carbon dioxide
COC	cyclic olefin copolymer
COC-Phs	cyclic olefin polymer with phenyl substituent
COF	covalent organic framework
COP	coefficient of performance (a measure of relative efficiency of a refrigerator stage)
COPV	composite overwrapped pressure vessel
CPNUVV	Cross-Polarized Near-Ultraviolet/Visible system
cPPSA	crosslinkable poly(phenylene sulfonic acid)
CRADA	Cooperative Research and Development Agreement
CRC	cyclic redundancy check
CS	carbon steel
CSA	Canadian Standards Association
CSA	compact solid oxide electrolysis cell architecture
CTE	coefficient of thermal expansion
D	diameter
d	de-alloyed
D-A	Dubinin-Astakhov
DAPP	Diels-Alder poly(phenylene)
dc	cathode electrode thickness
DEG	differentially expressed gene

DER	distributed energy resource
DF	direct fermentation
DFMA	Design for Manufacture and Assembly
DFT	density functional theory
dge	diesel gallon equivalent
DLHub	Data and Learning Hub for Science
DLS	dynamic light scattering
DMA	dynamic mechanical analysis
DMAc	N,N-dimethylacetamide
DME	dimethyl ether
DMFC	direct methanol fuel cell
DMR	de-acetylated and mechanically refined
DMSO	dimethylsulfoxide
DMTA	dynamic mechanical thermal analysis
DOE	U.S. Department of Energy
DOE/FCCJ	U.S. Department of Energy/Fuel Cell Commercialization Conference of Japan
DOT	U.S. Department of Transportation
DR	demand response
DRI	direct iron reduction
DRIFTS	diffuse reflectance infrared Fourier transform spectroscopy
DRTS	digital real-time simulator
DSC	differential scanning calorimetry
DSM 1313	Deutsche Sammlung von Mikroorganismen 1313
DSRC	dedicated short-range communication
Dy	dysprosium
$E_{1/2}$	half wave potential
E3	Energy and Environmental Economics
ECA	electrochemically active surface area
ECCC	Environment and Climate Change, Canada
ECSA	electrochemical surface area
EDC	Energy Dispatch Controller
EDS	energy-dispersive X-ray spectroscopy
EDTA	ethylenediaminetetraacetic acid
EELS	electron energy loss spectroscopy
EERE	Office of Energy Efficiency and Renewable Energy
EG	ethylene glycol
EHC	electrochemical hydrogen compressor
EIS	electrochemical impedance spectroscopy
EL	electrolyzer
EMFAC	emission factor
EMN	Energy Materials Network
ENG	expanded natural graphite
EOD	electro-osmotic drag
EoL	end of life
EOT	end of test
EPDM	ethylene propylene diene monomer rubber
ePTFE	expanded polytetrafluoroethylene
Er	erbium
ERMS	Emissions Research and Measurement Section
ETF	elevated temperature forming
ETFE	ethylene tetrafluoro ethylene polymer
EV	battery electric vehicle
EW	equivalent weight
EXAFS	extended X-ray absorption fine structure
F-	fluoride anion
FASTSim	Future Automotive Systems Technology Simulator
FC	fold change; fuel cell
FCA	fuel cell assembly
FCEB	fuel cell electric bus
FCET	fuel cell electric truck

FCEV	fuel cell electric vehicle
FCH JU	Fuel Cell and Hydrogen Joint Undertaking
FC-PAD	Fuel Cell Performance and Durability Consortium
FCPP	fuel cell power plant
FCS	fuel cell system
FCTO	Fuel Cell Technologies Office
FCTO MYRDD	Fuel Cell Technologies Office Multi-Year Research, Development, and Demonstration Plan
FCV	fuel cell vehicle
FE	finite element
Fe	iron
Fe,TM-N-C	iron-(transition metal)-nitrogen-carbon catalyst
FEC	frond end controller
FeN_4	iron atom coordinated to four nitrogen atoms
FeN_x	iron atom coordinated to "x" nitrogen atoms
F-MEC	fermentation and microbial electrolysis cell
FMVSS	Federal Motor Vehicle Safety Standard
FOA	funding opportunity announcement
FOM	figure of merit
FPM	feet per minute
FTA	Federal Transit Administration
FTIR	Fourier transform infrared spectroscopy
FY	fiscal year
g	O_2 partial pressure dependence
g/s	grams per second
GCMC	grand canonical Monte Carlo
Gd	gadolinium
GDC	$Gd_{0.1}Ce_{0.9}O_{1.95}$
GDE	gas diffusion electrode
GDL	gas diffusion layer
GEN-III	third generation active magnetic regenerative refrigerator prototype (120 K to 20 K span)
GGE	gasoline gallon equivalent
GH_2	gaseous hydrogen
GISAXS	grazing incident small-angle X-ray spectroscopy
GM	General Motors
GN_2	gaseous nitrogen
GNG	go-no go
GO	graphene oxide
GTR	Global Technical Regulation
GUI	graphical user interface
GWE	Greenway Energy, LLC
H	magnetic field strength (A/m)
H_2	hydrogen
H_2-O_2	hydrogen–oxygen (e.g., fuel cell)
H_2btdd	bis(1*H*-1,2,3-triazolo[4,5-*b*],[4′,5′-*i*])dibenzo[1,4]dioxin]
H_2PhOHpydc	6-(4-carboxy-2-hydroxyphenyl) nicotinic acid
H70	hydrogen service at 70 bar or 70 MPa
HAADF	high-angle annular dark-field
HAADF-STEM	high-angle annular dark field–scanning transmission electron microscopy
HCD	high current density; hydrogen contaminant detector
HCDP	hydroxide ceramic dual phase
HCF	hollow carbon fiber
HDPE	high-density polyethylene
HDSAM	Hydrogen Delivery Scenario Analysis Model
HDV	heavy-duty vehicle
HeIM	helium ion microscopy
HER	hydrogen evolution reaction
HEV	hybrid electric vehicle
HTEC	Hydrogen Technology & Energy Corporation
HF	hollow fiber

HFO	hydrous ferric oxide
HFP	hexafluoropropylene
HFPO	hexafluoropropylene oxide
HFR	high frequency resistance
HGV	hydrogen gas vehicle
HHC	Hawaii Hydrogen Carriers
HIL	hardware-in-the-loop
HiP	High Pressure Equipment Company
HiPoD	High Power Density Cell
HITRF	Hydrogen Infrastructure Testing and Research Facility
H-Mat	Hydrogen Materials Compatibility Consortium
HOR	hydrogen oxidation reaction
HPI	High Pressure Institute of Japan
HSA	high surface area
HSC	high surface area carbon
HSE	Health and Safety Executive (United Kingdom)
HSECoE	Hydrogen Storage Engineering Center of Excellence
HSP	Hydrogen Safety Panel
HTE	high-temperature electrolysis
HTF	heat transfer fluid
HT-PEMFC	high-temperature proton exchange membrane fuel cell
HTS	high-throughput screening
HTWS	high-temperature water splitting
HX	heat exchanger
HyMARC	Hydrogen Materials Advanced Research Consortium
HyRAM	Hydrogen Risk Assessment Model
HyWAM	Hydrogen Wide Area Monitoring
I/C	ionomer-to-carbon ratio
I:C	ionomer-to-carbon ratio
ICC	International Code Council
ICHS	International Conference on Hydrogen Safety
ICP-OES	inductively-coupled plasma–optical emission spectrometry
ICR	interface contact resistance
IEC	ion exchange capacity
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Fire Code
IL	ionic liquid
ILSS	inter-lamellar shear strength
INL	Idaho National Laboratory
IR	infrared
iR-free	voltage/potential corrected for cell resistance
ISO	International Organization for Standardization
IT	intermediate temperature
ITFC	intermediate-temperature fuel cell
IUPUI	Indiana University Purdue University Indianapolis
JRC	Joint Research Centre
KB	Ketjen black
kMC	kinetic Monte Carlo
kWnet	net kilowatt electric
L	length
L/D	length-to-diameter ratio
L3DP	laser 3-D printing
LAMMPS	Large-scale Atomic/Molecular Massively Parallel Simulator
LANL	Los Alamos National Laboratory
LBNL	Lawrence Berkeley National Laboratory
LCA	life cycle analysis
LCD	low current density
LCOS	levelized cost of storage
LDC	lanthanum doped ceria
LDV	light-duty vehicle
LGER	linear Gibbs energy relationship
LH_2	liquid hydrogen
LHC	liquid hydrogen carrier

LIN	liquid nitrogen
LLNL	Lawrence Livermore National Laboratory
LME	laboratory mixing extruder
LMRC	linear motor reciprocating compressor
LN_2	liquid nitrogen
LNO	lanthanum nickelate
LOHC	liquid organic hydrogen carrier
LP	low pressure
LP@PF	low Pt@PGM-free
LP@PFNF	low Pt@PGM-free nanofiber
LSCF	$(La,Sr)(Co,Fe)O_3$
LSCr	$La_{0.7}Sr_{0.3}CrO_3$
LTE	low-temperature electrolysis
LT-PEMFC	low-temperature proton exchange membrane fuel cell
M	magnetization (A/m)
m-dobdc	4,6-dioxido-1,3-benzenedicarboxylate
M/HDV	medium- and heavy-duty vehicle
MA	mass activity
MarFC	Maritime Fuel Cell Unit
MASC	multi-acid side chain
MATI	modular adsorbent tank insert
MAWP	maximum allowable working pressure
MBRC	miles between roadcall
MCE	magnetocaloric effect
MCH	methylcyclohexane
MCHL	magnetocaloric hydrogen liquefier
MD	molecular dynamics
MDF	Materials Data Facility
MDV	medium-duty vehicle
MDV/HDV	medium- and heavy-duty vehicle
MEA	membrane electrode assembly
MEC	microbial electrolysis cell
MFCS	multi-functional carbon support
MgB_2-THF	magnesium boride reacted with tetrahydrofuran
MH	metal hydride
MHC	metal hydride compressor
MIST	multichannel impedance spectroscopy
ML	machine learning; monolayer
MMC	multiple metal center
MMT	million metric ton
Mn	manganese
MO	metal oxide
MOF	metal organic framework
MOR	methanol oxidation reaction
MPa	megapascal
MPL	microporous layer
MPP	metal pyrophosphate
MRS	Materials Research Society
MS	milestone
MT	metric ton
MYRDD	Multi-Year Research, Development, and Demonstration Plan
n	number of electrons
N	number of cycles
NA	not applicable
NACFE	North American Council for Freight Efficiency
nano-CT	nanoscale-resolution (~50 nm) X-ray computed tomography; nano-computed tomography
NBR	nitrile butadiene rubber
NBSCF	$NdBa_{0.5}Sr_{0.5}Co_{1.5}Fe_{0.5}O_{5+\delta}$
NDA	non-disclosure agreement
NDC	neodymium doped ceria
NF	nanofiber
NFCTEC	National Fuel Cell Technology Evaluation Center
NFPA	National Fire Protection Association
NG	natural gas

NH_3	ammonia
NIR	near-infrared
NIST	National Institute of Standards and Technology
NMR	nuclear magnetic resonance
NNO	neodymium nickelate
NO	nitric oxide
NO_2^-	nitrite anion
NPA	1-propanol
NR	neutron reflectometry
NREL	National Renewable Energy Laboratory
NRTL	Nationally Recognized Testing Laboratory
NRVS	nuclear resonance vibrational spectroscopy
NSF DMREF	National Science Foundation Designing Materials to Revolutionize and Engineer our Future
NSTF	nanostructured thin film
NTCNA	Nissan Technical Center North America
NTO	niobium-doped titanium oxide
NU	Northwestern University
O&M	operations and maintenance
O_2	oxygen molecule
OBU	onboard unit—DSRC radio with a vehicle
OCV	open cell voltage; open circuit voltage
OEM	original equipment manufacturer
OER	oxygen evolution reaction
$OFeN_4$	iron atom coordinated to four nitrogen atoms and one oxygen atom
OH	hydroxyl group
$OHFeN_4$	iron atom coordinated to four nitrogen atoms and one hydroxyl group
OLR	organic loading rate
·OOH	hydroperoxyl radical
OQMD	Open Quantum Materials Database
ORNL	Oak Ridge National Laboratory
ORR	oxygen reduction reaction
P	pressure
P&ID	piping and instrumentation diagram
PAA	poly(acrylic acid)
PADD	Petroleum Administration for Defense Districts
PAN	polyacrylonitrile
PA-PBI	phosphoric acid poly(benzimidazole)
PAP-TP-Me	poly(aryl piperidine) triphenyl methyl
PAP-TP-MQN	poly(aryl piperidine) triphenyl mono quaternary ammonium
PBCC	$PrBa_{0.8}Ca_{0.2}Co_2O_{5+\delta}$
PBE	Perdew–Burke–Ernzerhof
PBEsol	Perdew–Burke–Ernzerhof revised for solids
PBI	polybenzimidazole
PBSCF	$PrBa_{0.5}Sr_{0.5}Co_{1.5}Fe_{0.5}O_{5+\delta}$
PCES	protonic ceramic electrolyzer stack
PCM	proton conducting membrane
PCT	pressure, composition, temperature
PDF	pair distribution function analysis
PDTS	[ISO designation yet to be assigned] Health indicators definitions, relationships and attributes, was prepared by Technical Committee ISO/TC 215, Health Informatics / Working Group 1 Health records and modeling coordination
PEC	photoelectrochemical
PEFC	polymer electrolyte fuel cell
PEM	polymer electrolyte membrane; proton exchange membrane
PEMFC	polymer electrolyte membrane fuel cell; proton exchange membrane fuel cell

PEMWE	proton exchange membrane water electrolyzer
PEO	poly(ethylene oxide)
PF	perfluoro
PFD	process flow diagram
PFIA	perfluoro imide-acid
PFSA	perfluorinated sulfonic acid; perfluorosulfonic acid
PG&E	Pacific Gas and Electric
PGM	platinum group metal
PGM-free	platinum group metal–free
PhNB	phenylnorbornene
PILBCP	polymerized ionic liquid block copolymer
PNC	$PrNiCoO_3$
PNNL	Pacific Northwest National Laboratory
PNO	$Pr_2NiO_{4+\delta}$
pO_2	oxygen partial pressure
ppb	parts per billion
ppm	parts per million
PPSU	poly(phenyl sulfone)
PRESLHY	Prenormative Research for the Safe Use of Liquid Hydrogen
PS	polystyrene
PSA	pressure swing adsorption
PSD	particle size distribution
psi	pound-force per square inch
psig	pounds per square inch gauge
Pt	platinum
Pt/C	carbon-supported platinum
Pt/MFCS	platinum/multi-functional carbon support
PtCo	platinum cobalt alloy
PTE	porous transport electrode
PTFE	polytetrafluoroethylene
PTL	porous transport layer
PtRu	platinum ruthenium
Pt_xCo_{1-x}	platinum-cobalt alloy
PVD	physical vapor deposition
PVDF	polyvinylidene fluoride
PVP	Pressure Vessels and Piping (Division of ASME)
Q	heat; stack heat load
QA	quaternary ammonium
QAPOH	biphosphate-quaternary ammonium poly(phenylene)
QC	quality control
QRA	quantitative risk analysis; quantitative risk assessment
R	gas constant
R&D	research and development
R2R	roll to roll
RCO	relevant cost of ownership
RCS	regulations, codes, and standards
RDA	rotating disk atomizer
RDE	rotating disk electrode
ReSOC	reversible solid oxide cell
RH	relative humidity
RHE	reversible hydrogen electrode
RLRS	rapid laser reactive sintering
RMSE	root mean square error
RNA-seq	ribonucleic acid sequencing
RPI	Rensselaer Polytechnic Institute
RRDE	rotating ring-disk electrode
RSU	roadside unit—stationary DSRC radio installed inside the dispenser system
RTO	ruthenium dioxide–titanium dioxide
RTS	real-time simulation
s/c	superconducting magnet
SA	Strategic Analysis Inc.
SAE	SAE International
SAXS	small angle X-ray scattering
SBIR	Small Business Innovation Research
sc	cathode ionic conductivity

SCAN	strongly constrained and appropriately normed
sccm	standard cubic centimeters per minute
SCE	Southern California Edison
SCS	safety, codes and standards
SDO	standards development organization
SEBS	poly(styrene-b-(ethylene-co-butylene)-b-styrene)
SEM	scanning electron microscopy
SERA	Scenario Evaluation and Regionalization Analysis
SES	poly(styrene-b-ethylene-b-styrene)
SFR	stagnation flow reactor
SG	Saint-Gobain
SIO	Scripps Institution of Oceanography
SLD	scattering length density
SMR	steam methane reforming
SMSI	strong metal support interaction
SNL	Sandia National Laboratories
SOA	state of the art
SOE	solid oxide electrolysis
SOEC	solid oxide electrolysis cell
SOFC	solid oxide fuel cell
SPP	solid phase processing
SPPARKS	Stochastic Parallel PARticle Kinetic Simulator
SPS	suspension plasma spray
SPt	platinum surface roughness
SR	stoichiometry
SRNL	Savannah River National Laboratory
SS	stainless steel
SSM	sacrificial support method
SSRS	solid state reactive sintering
STCH	solar thermochemical hydrogen
STEM	scanning transmission electron microscopy
STEM-EDS	scanning transmission electron microscopy with energy-dispersive X-ray spectroscopy
STF	$Sr(Ti_{0.3}Fe_{0.7})O_3$
STFC	$Sr(Ti_{0.3}Fe_{0.63}Co_{0.07})O_3$
STTR	Small Business Technology Transfer
STXM	scanning transmission X-ray microscopy
SwRI	Southwest Research Institute
sys/yr	systems per year
T	temperature
TBD	to be determined
T_c	catalyst coated layer temperature
TCF	Technology Commercialization Fund
TCO	total cost of ownership
TCOLD	average cold temperature of a regenerator
TEA	techno-economic analysis
TEM	transmission electron microscopy
TEM-EDS	transmission electron microscopy with energy-dispersive X-ray spectroscopy
TEM-EELS	transmission electron microscopy with electron energy loss spectroscopy
TF-RDE	thin-film rotating disk electrode
T_g	glass transition temperature
TGA	thermogravimetric analysis
THF	tetrahydrofuran
T_{HOT}	average hot temperature of a regenerator
TiN	titanium nitride
TiO_x	titanium oxide
TIR	Technical Information Report
TKK	Tanaka Kikinzok
TMA	trimethylamine; trimethylammonium
TMAB	tetramethylammonium borohydride

TMAC6PP	hexamethyl ammonium functionalized Diels-Alder poly(phenylene)
TPD	temperature programmed desorption
TPN	alkyl ammonium functionalized poly(terphenylene)s
TPP	tin pyrophosphate
TPV	total present value
T_r	reference temperature, 353 K
TRL	technology readiness level
TS	Technical Standard
TTA	technology transfer agreement
TUS	take up system
UALR	University of Arkansas at Little Rock
UCD	University of California, Davis
UK CAER	University of Kentucky Center for Applied Energy Research
ULCL	ultra-low catalyst loading
UN	United Nations
UPS	United Parcel Service
URFC	unitized reversible fuel cell
USAXS	ultra-small angle X-ray scattering
USCG	United States Coast Guard
UTF	ultra-thin film
UTRC	United Technologies Research Center
UV-Vis	ultraviolet to visible (wavelength)
VACD	variable area control device
VACNF	vertically aligned carbon nanofibers
VC	Vulcan carbon
VCC	vapor compression cycle
VTIR	variable temperature infrared
WaMM	water management membrane
WAVE	Wireless Access in Vehicular Environments
WAXS	wide-angle X-ray scattering
wt %	weight percent
X	mole fraction
XAFS	X-ray adsorption fine structure spectroscopy
XANES	X-ray absorption near edge structure spectroscopy
XAS	X-ray absorption spectroscopy
XCT	X-ray computed tomography
XPS	X-ray photoelectron spectroscopy
XRD	X-ray diffraction
XRF	X-ray fluorescence
XRS	X-ray Raman scattering
YSZ	3% yttria-stabilized zirconium oxide
YSZ	$(ZrO_2)_{0.92}(Y_2O_3)_{0.08}$
ZIF	zeolitic imidazolate framework
Zn	zinc
Z-N	Ziegler-Natta
ZSM-5	Zeolite Socony Mobil-R, an aluminosilicate zeolite with the chemical formula $Na_nAl_nSi_{96-n}O_{192}\cdot 16\ H_2O$ ($0<n<27$)