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Proton transport through non-covalently functionalized graphene

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“Through Measurement to Knowledge.”

Heike Kamerlingh Onnes

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List of Abbreviations

2D	Two-dimensional
AFM	Atomic force microscopy
APS	Ammonium persulfate
AST	Accelerated stress test
CE	Counter electrode
CL	Catalyst layer
CMC	Critical micelle concentration
CSAC	Critical surface aggregation concentration
CV	Cyclic voltammetry
CVD	Chemical vapor deposition
D ⁺	Deuteron
D ₂ O	Deuterium oxide, heavy water
DMFC	Direct methanol fuel cell
EDS	Energy dispersive X-ray spectroscopy
EDX	Energy dispersive X-ray
EIS	Electrochemical impedance spectroscopy
EW	Equivalent weight
GDL	Gas diffusion layer
GISAXS	Grazing-incidence small-angle X-ray scattering
Gr	Graphene
hBN	Hexagonal boron nitride
HER	Hydrogen evolution reaction
HOPG	Highly ordered pyrolytic graphite
HTFSI	Bis(trifluoromethane)sulfonimide
HT-PEMFC	High-temperature proton exchange membrane fuel cell
i-t	Chronoamperometry
I-V	Current-Voltage
LC	Liquid chromatography
MEA	Membrane electrode assembly
MeOD	Deuterated methanol

MLG	Monolayer graphene
MR	Membered ring
N211/G/N211	Nafion 211/Graphene/Nafion 211
NMR	Nuclear magnetic resonance
OCV	Open circuit voltage
OER	Oxygen evolution reaction
PA	Phosphoric acid
PBI	Polybenzimidazole
PC	Polycarbonate
PCA	1-Pyrene carboxylic acid
PCET	Proton-coupled electron transfer
PEEK	Poly(ether ether ketone)
PEM	Proton exchange membrane
PEMFC	Proton exchange membrane fuel cell
PFSA	Perfluorosulfonic acid
PMMA	Poly(methyl methacrylate)
PMPS	3-(pyrene-1-yl-methoxy)propane-1-sulfonate
PMPS/Gr	PMPS-functionalized graphene
PTFE	Polytetrafluoroethylene
QRCE	Quasi-reference counter electrode
QRE	Quasi-reference electrode
RE	Reference electrode
SDS	Sodium dodecyl sulfate
SDS-Gr	SDS-treated graphene
SECCM	Scanning electrochemical cell microscopy
SEM	Scanning electron microscopy
SFG	Sum-frequency generation
SFVS	Sum-frequency vibrational spectroscopy
SLG	Single layer graphene
UV-Vis	Ultraviolet-Visible
V_B	Bias
WE	Working electrode
WSE	Working sense electrode
XPS	X-ray photoelectron spectroscopy