

Supplementary Information

Solar fuels: Research and development strategies to accelerate photocatalytic CO₂ conversion into hydrocarbon fuels

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List of Abbreviations

Abbreviation	Full name	Abbreviation	Full name
0D	Zero-dimensional	NPs	Nanoparticles
1D	One-dimensional	NSs	Nanosheets
2D	Two-dimensional	PAW	Projector augmented-wave
AQY	Apparent quantum yield	PBE	Perdew-Burke-Ernzerhof
BSE	Bethe-Salpeter equation	PCET	Proton-coupled electron transfer
CB	Conduction band	PL	Photoluminescence
CBM	Conduction band minimum	PSM	Post-synthesis modification
CQDs	Carbon quantum dots	QDs	Quantum dots
DFT	Density functional theory	RGO	Reduced graphene oxide
DRIFTS	Diffuse reflectance infrared Fourier transform spectroscopy	SEM	Scanning electron microscopy
EE	Energetic efficiency	SEG	Solvent-exfoliated graphene
EPR	Electron paramagnetic resonance	SIMS	Secondary-ion mass spectrometry
FE	Faradaic efficiency	SPR	Surface plasmon resonance
GC-MS	Gas Chromatography-Mass Spectrometry	SRGO	Solvent-reduced graphene oxide
GGA	Generalized gradient approximation	STF	Solar-to-fuel efficiency
GGGI	Global Green Growth Institute	SZF	Single-zone furnaces
GHGT	International Conference on Greenhouse Gas Control Technologies	TAS	Transient absorption spectroscopy
GIXANES	Grazing-incidence X-ray absorption near-edge structure	TEM	Transmission electron microscopy
GO	Graphene oxide	TMDCs	Transition-metal dichalcogenides
GW	Gradient wave	TOF	Turnover frequency
HER	Hydrogen evolution reaction	TON	Turnover number
HOMO	Highest occupied molecular orbital	TRPL	Time-resolved photoluminescence
ICCDU	International Conference on Carbon Dioxide Utilization	TZF	Three-zone furnaces
IR	Infrared	UNEP	United Nations Environment Programme
IPCC	Intergovernmental Panel on Climate Change	UNFCCC	United Nations Framework Convention on Climate Change
KIT	Karlsruhe Institute of Technology	UV	Ultraviolet
LDH	Layered double hydroxide	VB	Valence band
LH	Langmuir-Hinshelwood	VASP	Vienna Ab initio simulation package
LSPR	Local surface plasmon resonance	WRI	World Resources Institute
LUMO	Lowest unoccupied molecular orbital	XAFS	X-ray absorption fine structure
MOFs	Metal-organic frameworks	XANES	X-ray absorption near-edge structure
MS	Mass spectroscopy	XAS	X-ray absorption spectroscopy
NAMD	Nonadiabatic molecular dynamics	E_g	Bandgap
NHE	Normal hydrogen electrode	m_e^*	Charge carrier effective mass
NIR	Near-infrared	ΔG	Gibbs free energy
NMR	Nuclear magnetic resonance		

※ Symbols associated with equations are explained in the main article.