

Appendix

C

Semiconducting
Materials Employed in PEC**Table C.1** Listing of the possible semiconducting materials for PEC and other applications.

Group	Material	Chemical Formula	Value of Band Gap in eV	Type of Band Gap	Remarks
IV	Diamond	C	5.47	Indirect	Good thermal Conductivity
IV	Silicon	Si	1.1	Indirect	Electrical mechanical properties
IV	Germanium	Ge	0.67	Indirect	Radar devices
IV	Silicon Carbide	SiC	2.3	Indirect	LED
IV	Silicon Germanium	SiGe	0.67 to 1.11	Indirect	Hetero Junctions
III-V	Aluminium antimonide	AlSb	1.6/2.2	Indirect/direct	
III-V	Aluminium arsenide	AlAs	2.16	Indirect	
III-V	Aluminium Nitride	AlN	6.28	Direct	Not much use
III-V	Aluminium Phosphide	AlP	2.45	Indirect	
III-V	Boron Nitride (C/ H/NT)	BN	6.36/5.96/ 5.5	Indirect quasi direct	LED
III-V	Boron Phosphide	BP	2	Indirect	
III-V	Boron arsenide	BAs	1.5	Indirect	
III-V	Gallium antimonide	GaSb	0.73	Direct	IR detector and LED
III-V	Gallium arsenide	GaAs	1.43	Direct	Electronic applications
III-V	Gallium nitride	GaN	3.44	Direct	Electronic applications
III-V	Gallium Phosphide	GaP	2.26	Indirect	LED
III-V	Indium antimonide	InSb	0.17	direct	IR detectors
III-V	Indium arsenide	InAs	0.36	direct	Infra red detectors

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Table C.1 (Continued)

<i>Group</i>	<i>Material</i>	<i>Chemical Formula</i>	<i>Value of Band Gap in eV</i>	<i>Type of Band Gap</i>	<i>Remarks</i>
III-V	Indium Nitride	InN	0.7	direct	Solar cells
III-V	Indium Phosphide	InP	1.35	direct	Optoelectronics
III-V	Aluminium gallium arsenide	AlGaAs	1.42 to 2.16	Direct/indirect	Solar cells
III-V	Indium gallium	InGaAs	0.36 to 1.43	Direct	IR and thermo-photovoltaics
III-V	Gallium arsenide phosphide	GaAsP	1.43 to 2.26	Direct indirect	LED
III-V	Gallium arsenide antimonide	GaAsSb	0.7 to 1.42	Direct	
III-V	Aluminium gallium nitride	AlGaN	3.44 to 6.28	Direct	
III-V	Aluminium gallium phosphide	AlGaP	2.26 to 2.45	Indirect	LED
III-V	Indium gallium nitride	InGaN	2 to 3.4	direct	LED
II-VI	Cadmium selenide	CdSe	1.74	Direct	Optoelectronics and solar cells
II-VI	Cadmium sulphide	CdS	2.42	Direct	Solar cells
II-VI	Cadmium telluride	CdTe	1.49		Solar cells
II-VI	Zinc oxide	ZnO	3.37	Direct	Photo-catalysis
II-VI	Zinc Selenide	ZnSe	2.7	Direct	Lasers and LED
II-VI	Zinc Sulphide	ZnS	3.54/3.91	direct	Scintillator
II-VI	Zinc Telluride	ZnTe	2.25	Direct	Lasers and LED
II-VI	Cadmium zinc telluride(CZT)	CdZnTe	1.4 to 2.2	direct	X/gamma ray detector
II-VI	Mercury Cadmium telluride	HgCdTe	0 to 1.5		IR detectors
II-VI	Mercury Zinc Telluride	HgZnTe	0 to 2.25	IR detectors	
I-VII	Cuprous chloride	CuCl	3.4	Direct	
I-VI	Copper sulphide	Cu ₂ S	1.2	Direct	Solar cells
IV-VI	Lead selenide	PbSe	0.27	Direct	IR detectors
IV-VI	Lead(II) sulphide	PbS	0.37		IR detectors
IV-VI	Lead telluride	PbTe	0.32		Thermoelectric material
IV-VI	Tin sulphide	SnS	1.0	Indirect	
IV-VI	Tin sulphide	SnS ₂	2.2		
IV-VI	Titanium oxide anatase	TiO ₂	3.2		Photocatalytic

Table C.1 (Continued)

<i>Group</i>	<i>Material</i>	<i>Chemical Formula</i>	<i>Value of Band Gap in eV</i>	<i>Type of Band Gap</i>	<i>Remarks</i>
IV-VI	Titanium oxide rutile	TiO ₂	3.02		Photo-catalytic
IV-VI	Titanium oxide Brookite	TiO ₂	2.96		
I-VI	Copper (I) oxide	Cu ₂ O	2.1	p-type	Rectifier diodes
I-VI	Copper (II) oxide	CuO	1.2		
III-VI	Uranium dioxide	UO ₂	1.3		Thermoelectric applications
IV-VI	Tin oxide	SnO ₂	3.7		
II-IV-VI	Barium Titanate	BaTiO ₃	3		Ferro-electric applications
II-IV-VI	Strontium titanate	SrTiO ₃	3.3		Ferroelectric
I-V-VI	Lithium niobate	LiNbO ₃	4		Ferroelectric
III-I-VI	Lanthanum copper oxide	La ₂ CuO ₄	2		Super conductor
IV	Selenium	Se	1.74		Rectifiers
VIII-VI	Iron disulphide	FeS ₂	0.95		Solar cells
VIII-VI	Ferric oxide	Fe ₂ O ₃	2.1		
V-VI	Niobium pentoxide	Nb ₂ O ₅	3.4		
V-VI	Tantalum Pentoxide	Ta ₂ O ₅	3.9 to 4.5		
VIII-VI	Nickel oxide	NiO	1.34/2.92		
IV-V-VI	Tin niobate	SnNb ₂ O ₆	1.49		
IV-V-VI	Tin tantalite	SnTa ₂ O ₆	2.03		
IV-V-VI	Tin niobate	Sn ₂ Nb ₂ O ₇	1.11		
IV-V-VI	Tin tantalate	Sn ₂ Ta ₂ O ₇	1.41		
VI-VI	Tungsten oxide	WO ₃	2.8		
IV-VI	Zirconium oxide	ZrO ₂	4.60		
III-VI	Indium oxide	In ₂ O ₃	3.6 to 3.9	direct	
VI-VI	Tungsten sulphide	WS ₂	1.80		
V-VI	Bismuth sulphide	Bi ₂ S ₃	1.5 to 1.74		
I-V-VI	Potassium tantalate	KTaO ₃	3.42		
I-V-VI	Sodium niobate	NaNbO ₃	3.08		
I-V-VI	Potassium niobate	KNbO ₃	1.97/3.30		
I-V-VI	Sodium tantalate	NaTaO ₃	2.35		
V-Vi-VI	Bismuth molybdate	Bi ₂ MoO ₆	2.70/3.02		
V-VI-VI	Bismuth molybdate	Bi ₂ Mo ₃ O ₉	3.10		

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Table C.1 (*Continued*)

<i>Group</i>	<i>Material</i>	<i>Chemical Formula</i>	<i>Value of Band Gap in eV</i>	<i>Type of Band Gap</i>	<i>Remarks</i>
V-VI-VI	Bismuth molybdate	$\text{Bi}_2\text{Mo}_3\text{O}_{12}$	2.88		
VI-VI	Tungsten selenide	WSe_2	1.37		
VIII-VI-VI	Nickel molybdate	NiMoO_4	2.81		
I-V-VI-VI	Sodium bismuth molybdate	$\text{NaBi}(\text{MoO}_4)_2$	3.0		
I-V-VI-VI	Silver bismuth molybdate	$\text{AgBi}(\text{MoO}_4)_2$	2.9		
III-VI-VI	Lanthanum molybdate	$\text{La}_2(\text{MoO}_4)_3$	2.30		
III-VI-VI	Europium molybdate	$\text{Eu}_2(\text{MoO}_4)_3$	3.20		
I-V-VI-VI	Sodium bismuth tungstate	$\text{NaBi}(\text{WO}_4)_2$	3.5		
VI-V-VI	Lead niobate	$\text{Pb}_3\text{Nb}_2\text{O}_8$	2.72		
VI-V-VI	Lead niobate	$\text{Pb}_3\text{Nb}_4\text{O}_{13}$	2.95		
I-V-VI	Lithium niobate	LiNbO_3	3.7/4.7		
III-V-VI	Lanthanum tantalate	$\text{La}_4\text{Ti}_3\text{O}_{12}$	3.95		
II-IV-VI	Strontium titanate	$\text{Sr}_3\text{Ti}_2\text{O}_7$	3.2		
II-V-VI	Calcium niobate	$\text{Ca}_2\text{Nb}_2\text{O}_7$	4.3		
IV-VI-VI	Lead tungstate	PbWO_4	4.7		
IV-VI-VI	Lead molybdate	PbMoO_4	4.0		
VIII-VI	Cobalt sesquioxide	Co_3O_4	1.23/1.54	Direct/indirect	
VIII-III-VI	Cobalt aluminate	CoAl_2O_4	2.0		
IV-VI	Tin oxide	SnO_2	3.50		
V-VI	Antimony oxide	Sb_2O_3	3.0		
V-VI	Bismuth oxide	Bi_2O_3	2.80		
V-VI	Tantalum oxide	Ta_2O_5	3.95		
VIII-VI	Cobalt oxide	CoO	2.60		
II-IV-VI	Magnesium titanate	MgTiO_3	3.70		
II-IV-VI	Barium titanate	BaTiO_3	3.20		
I-V-VI	Lithium Niobate	LiNbO_3	3.80		