

Thin-Film PV Technologies

CdTe PV Technology

Week 5.4

Arno Smets

CdTe

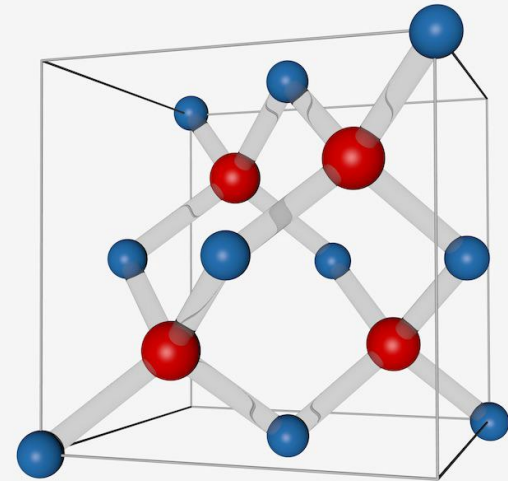
IV semiconductors

III-V semiconductors

II-VI semiconductors

CdTe:

		VIII A							
		IIIA	IIIA	IIIA	IIIA	IIIA	IIIA		
		5	6	7	8	9	10		
		B	C	N	O	F	Ne		
		10.811	12.011	14.007	15.999	18.998	20.180		
		13	14	15	16	17	18		
		Al	Si	P	S	Cl	Ar		
		26.982	28.086	30.974	32.065	35.453	39.948		
IB	IIB	29	30	31	32	33	34	35	36
		Cu	Zn	Ga	Ge	As	Se	Br	Kr
		63.546		69.723	72.64	74.922		79.904	83.798
		47	48	49	50	51	52	53	54
		Ag	Cd	In	Sn	Sb	Te	I	Xe
		107.87	112.41	114.82	118.71	121.76	127.60	126.90	131.29
		79	80	81	82	83	84	85	86
		Au	Hg	Tl	Pb	Bi	Po	At	Rn
		196.97	200.59	204.38	207.2	208.98	[209]	[210]	[222]



CdTe n-doping

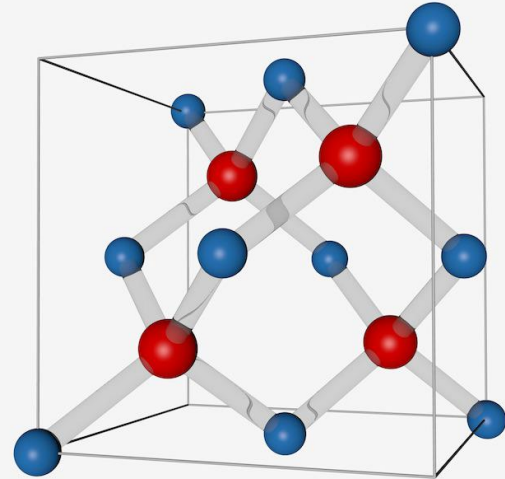
IV semiconductors

III-V semiconductors

II-VI semiconductors

		III A		IV A		V A		VI A		VII A		VIII A	
		5	6	7	8	9	10					2	
		B	C	N	O	F	Ne					He	
		10.811	12.011	14.007	15.999	18.998	20.180					4.0026	
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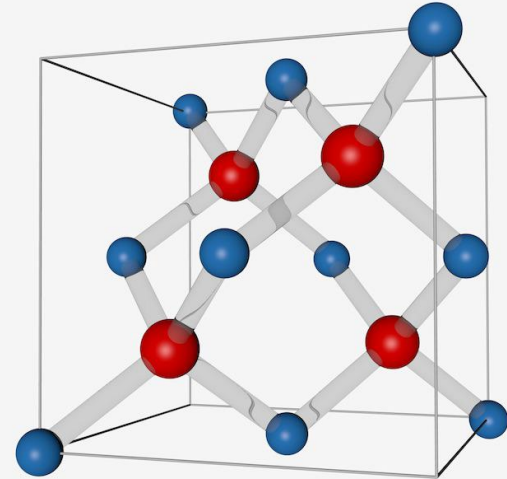
CdTe n-doping

IV semiconductors

III-V semiconductors

II-VI semiconductors

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CdTe n-doping

IV semiconductors

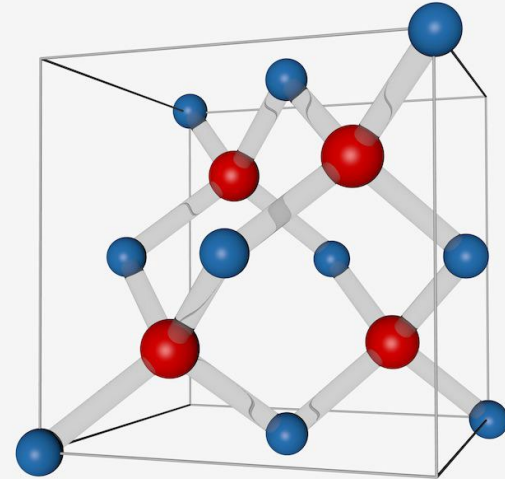
III-V semiconductors

II-VI semiconductors

		IIIA		IVA		VA		VIA		VIIA		VIIIA	
		5	6	7	8	9	10					2	
		B	C	N	O	F	Ne					He	
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CdTe:

Te vacancy



CdTe p-doping

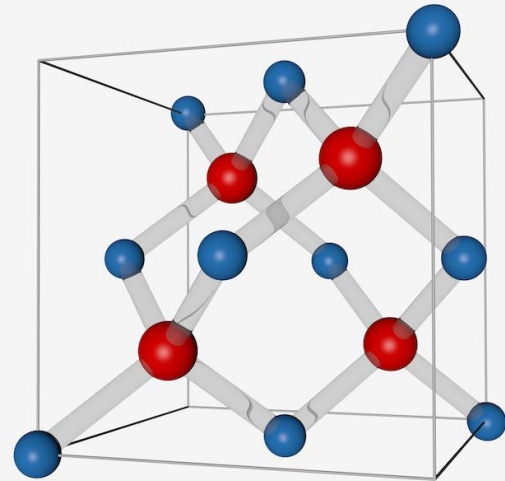
IV semiconductors

III-V semiconductors

II-VI semiconductors

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CdTe:



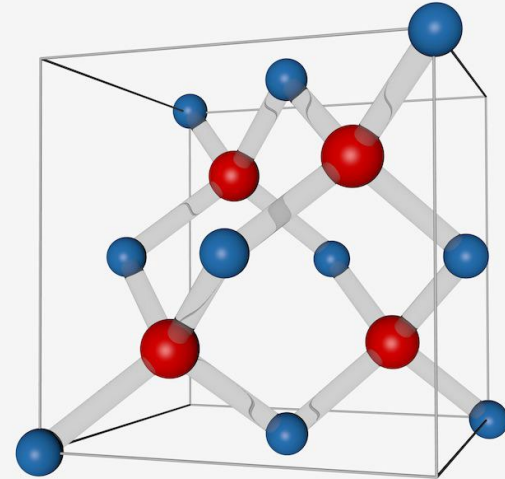
CdTe p-doping

IV semiconductors

III-V semiconductors

II-VI semiconductors

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CdTe p-doping

IV semiconductors

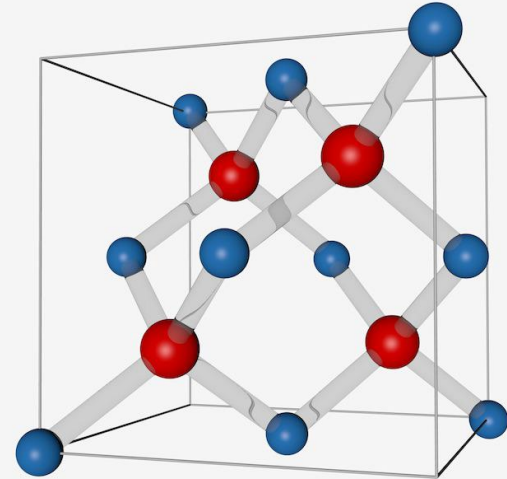
III-V semiconductors

II-VI semiconductors

		VIII A								
		IIIA	IIIA	IVA	IVA	VIA	VIA	VIIA	VIIA	VIIIA
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CdTe:

Cd vacancy

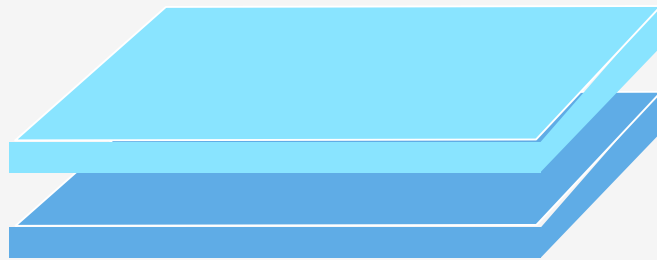


CdTe solar cell



Glass

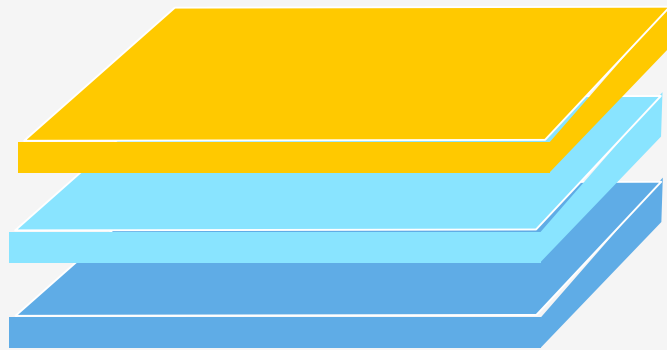
CdTe solar cell



SnO₂

Glass

CdTe solar cell



CdS Buffer

SnO₂

Glass

CdTe solar cell



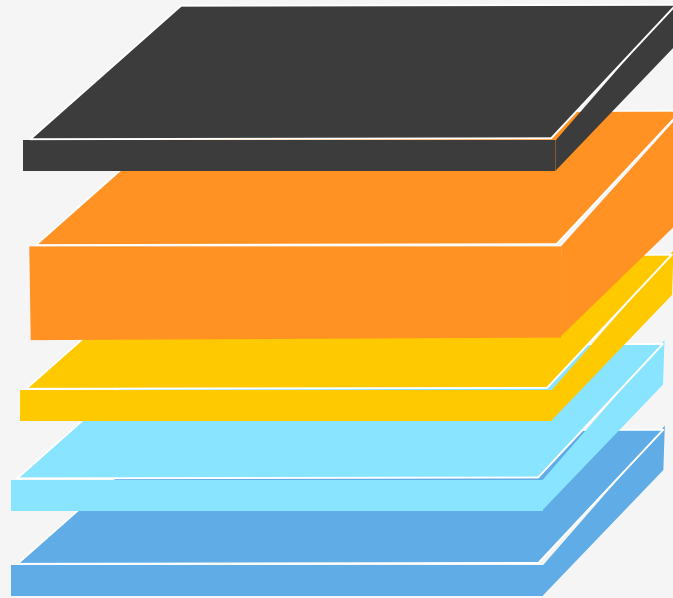
CdTe

CdS Buffer

SnO₂

Glass

CdTe solar cell



metal contact

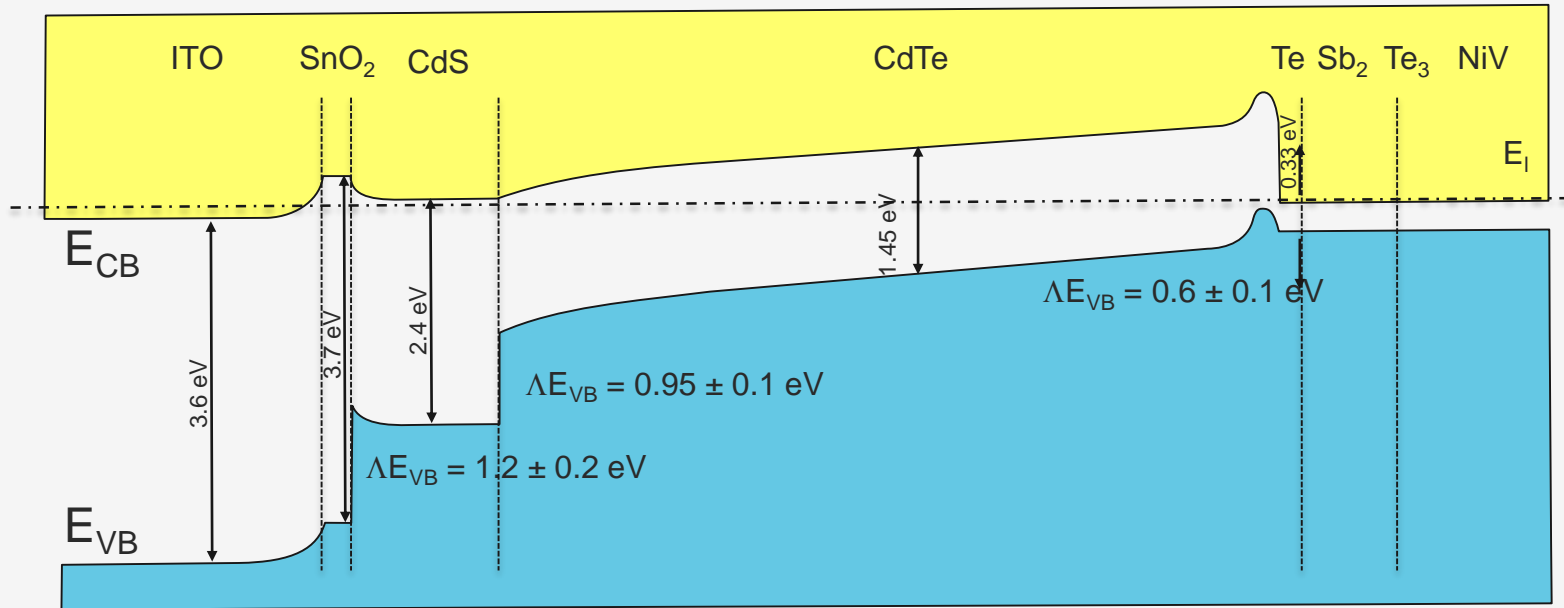
CdTe

CdS Buffer

SnO₂

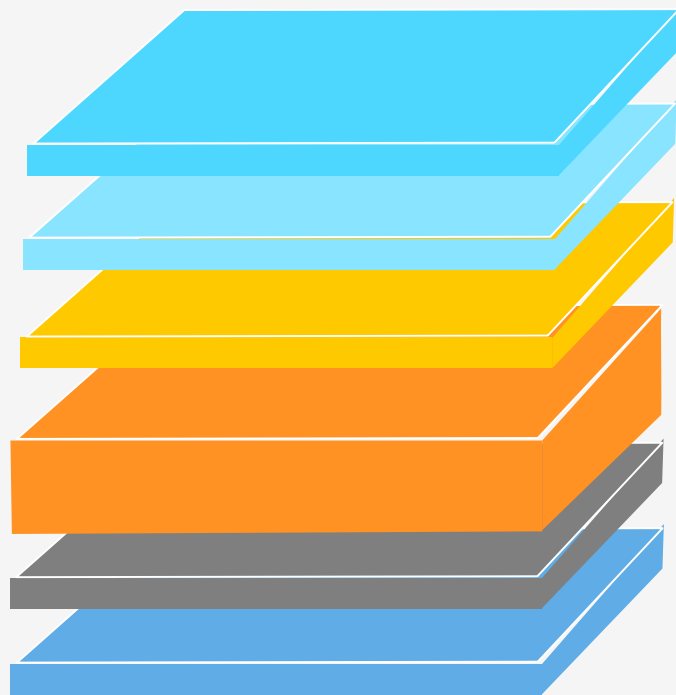
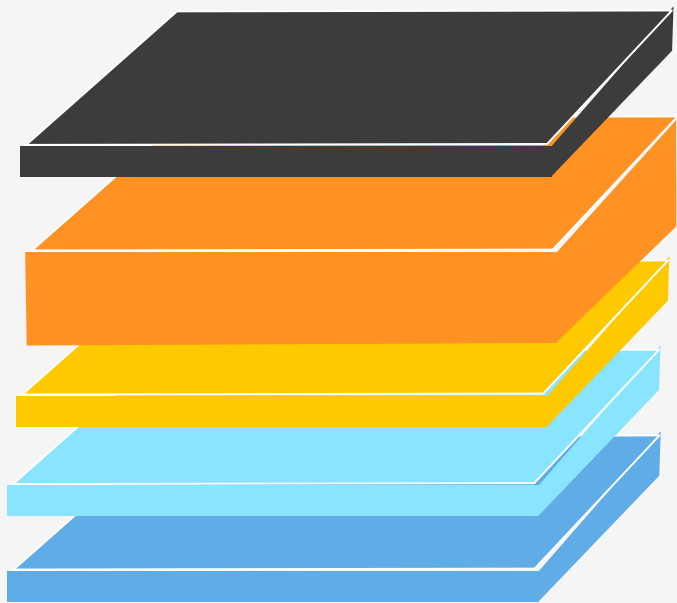
Glass

CdTe solar cell band diagram



CdTe solar cell

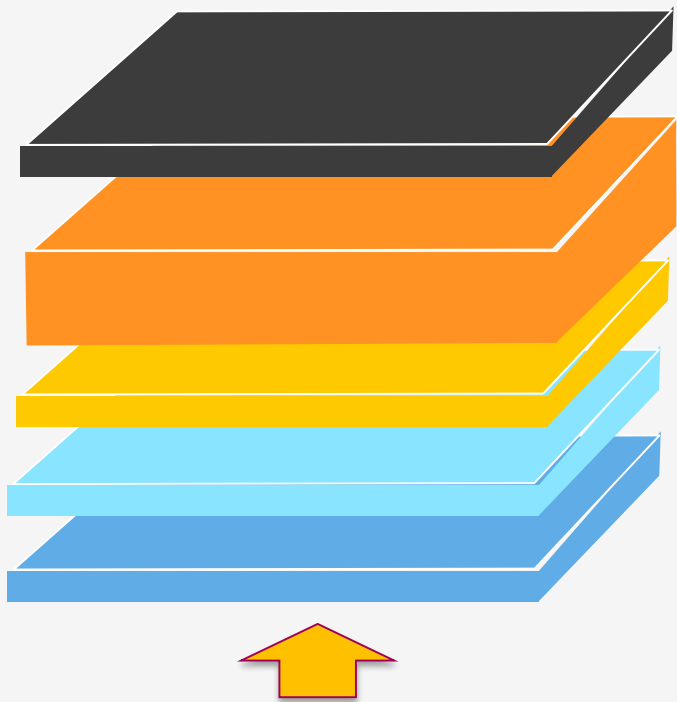
superstrate



substrate

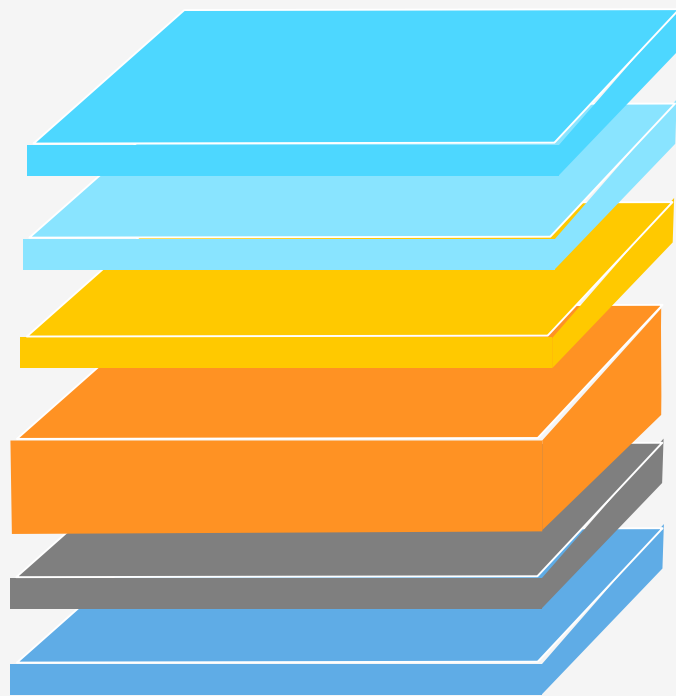
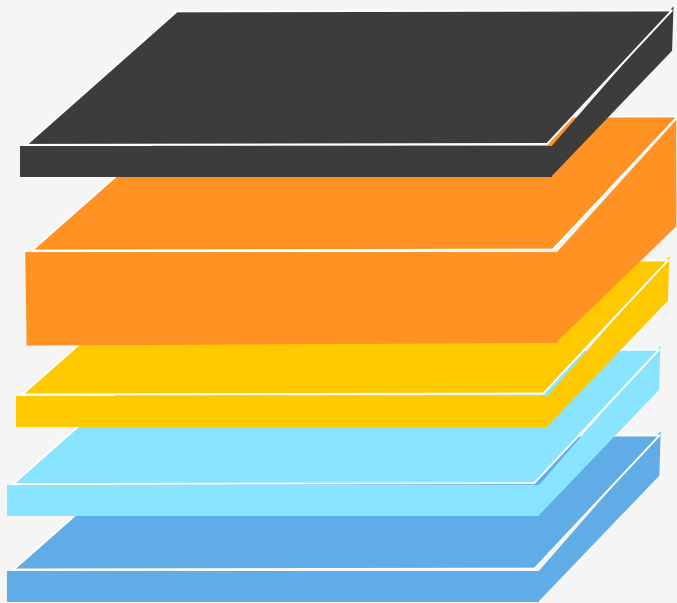
CdTe solar cell

superstrate



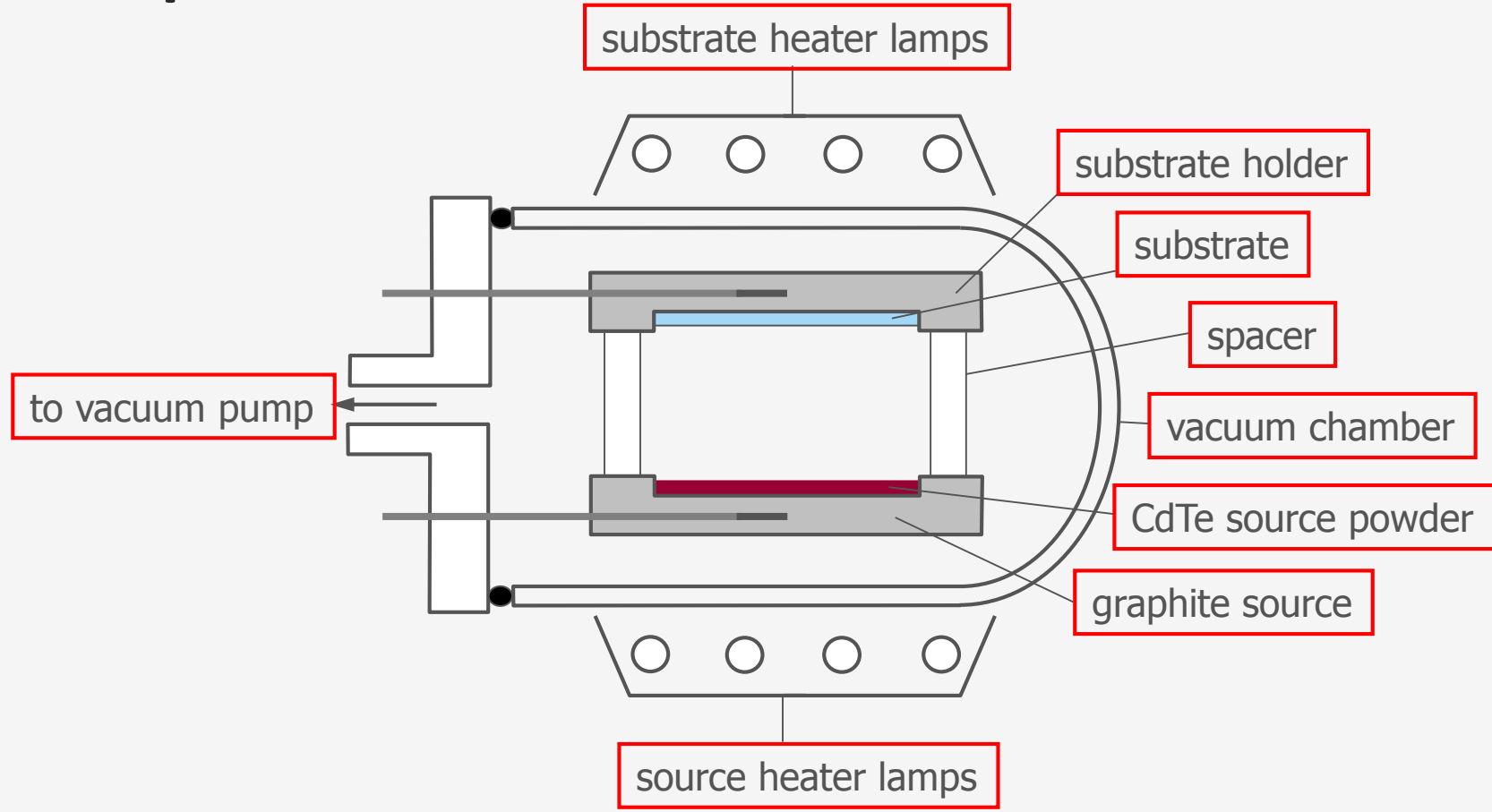
CdTe solar cell

superstrate

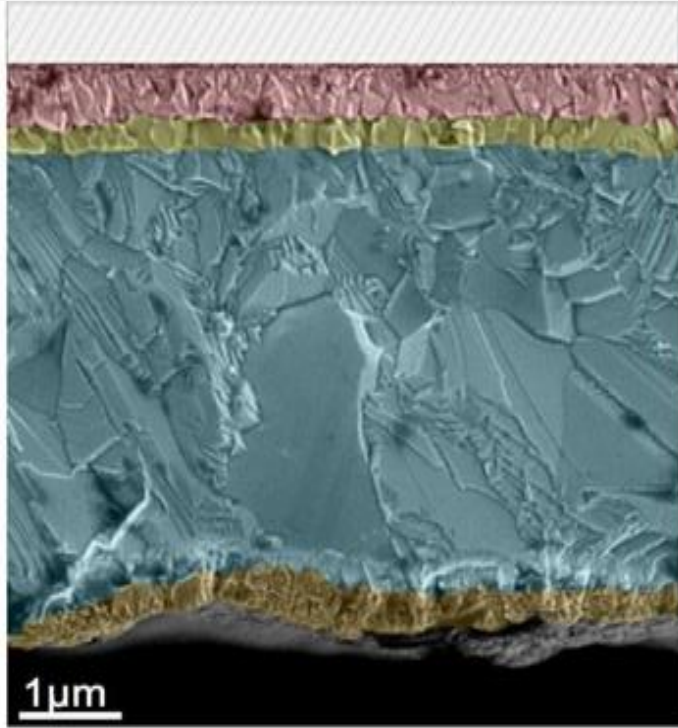


substrate

Closed Space Sublimation



Labscale CdTe solar cells



Glass
SnO₂
CdS

CdTe

ZnTe:Cu
Ti

First solar

Eff = 18.7 %

Voc ~ 852 mV

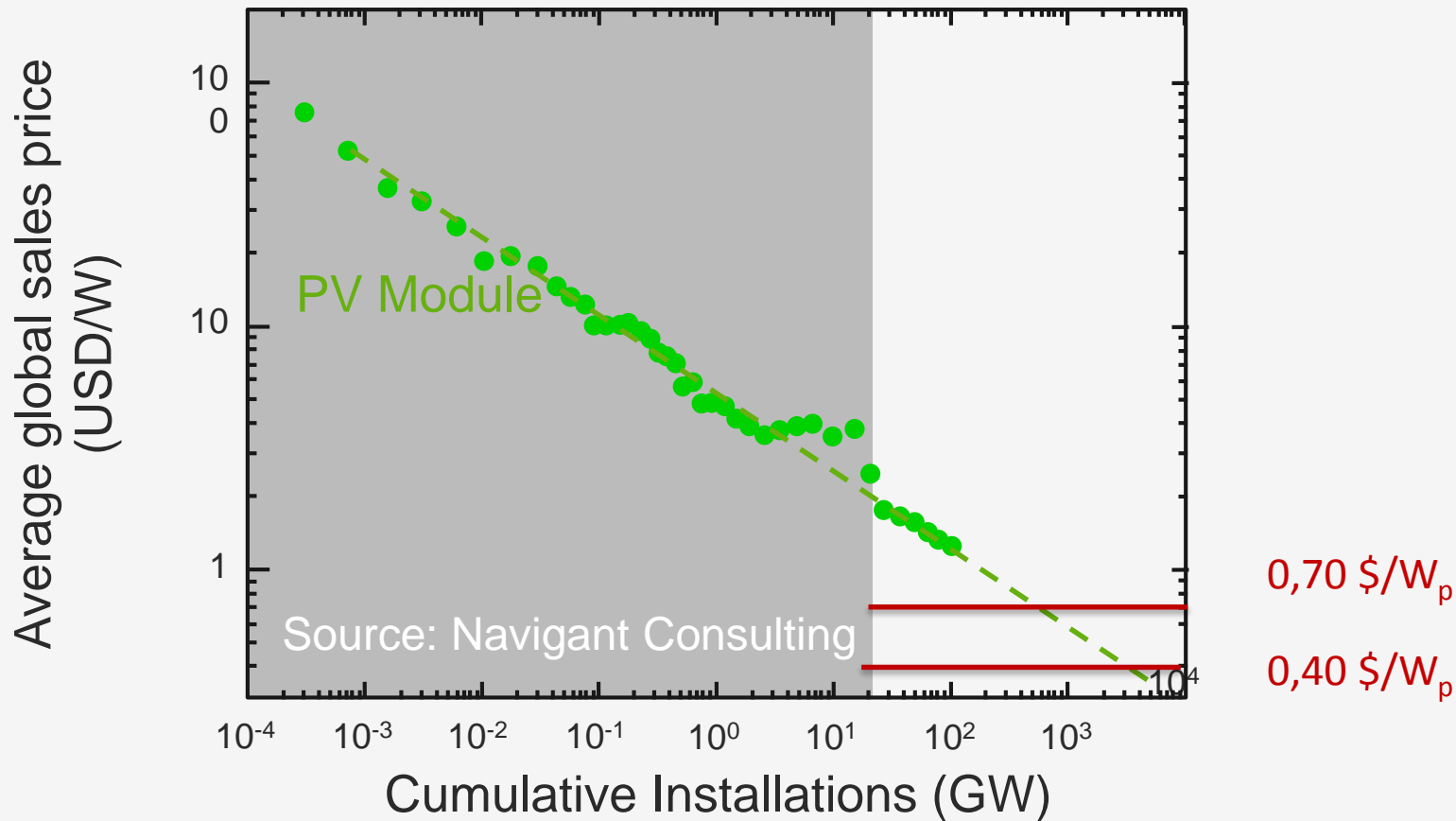
$J_{sc} \sim 28.6 \text{ mAcm}^{-2}$

FF = 76.76 %

GE Research

Eff: 18.3 %

Learning curve: PV modules, systems



Concerns: toxicity

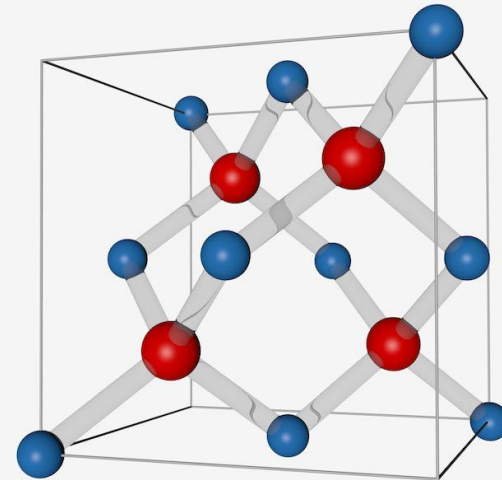
IV semiconductors

III-V semiconductors

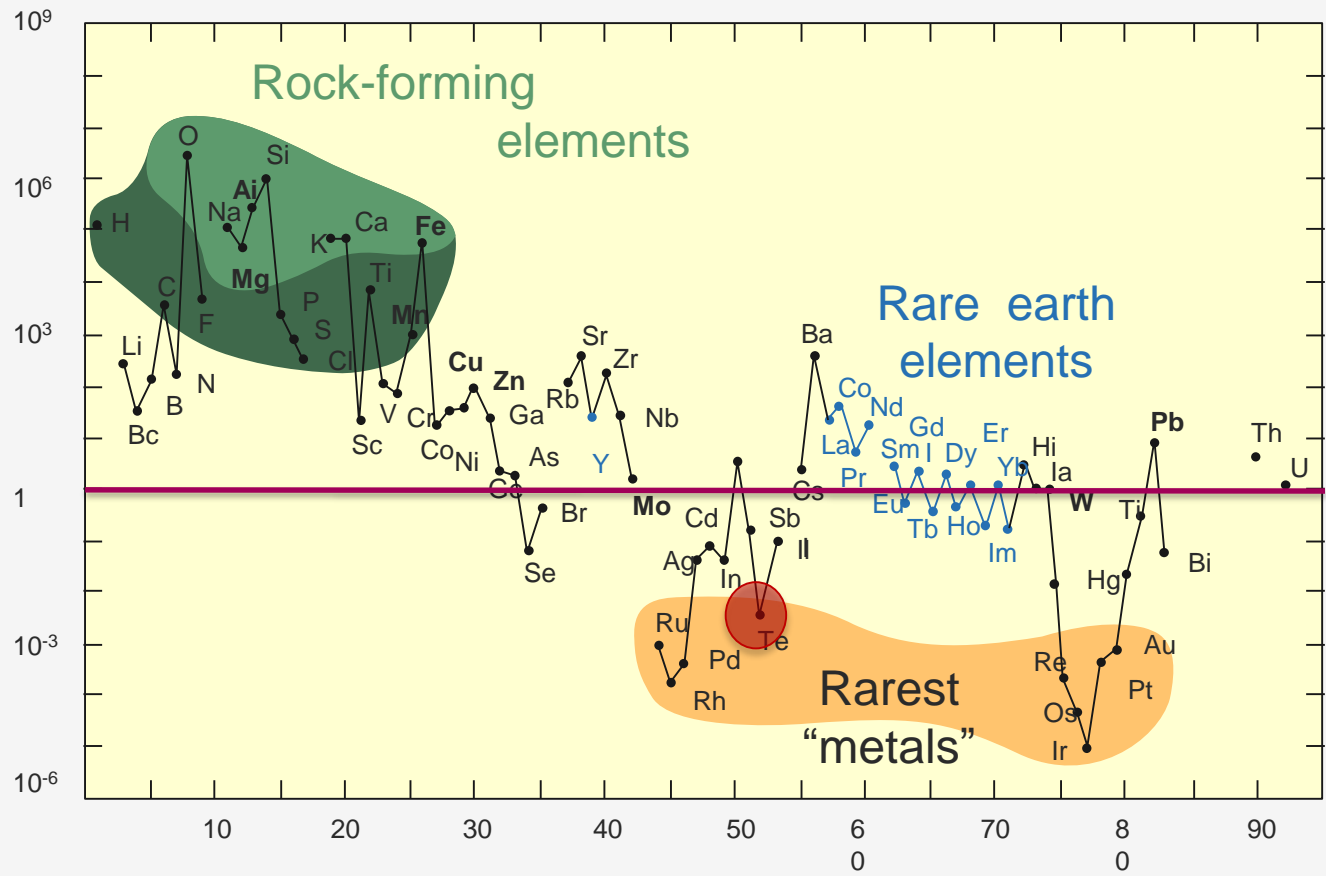
II-VI semiconductors

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		IIIA	IIIA	IVA	IVA	VA	VA	VIA	VIA	VIIA	VIIA
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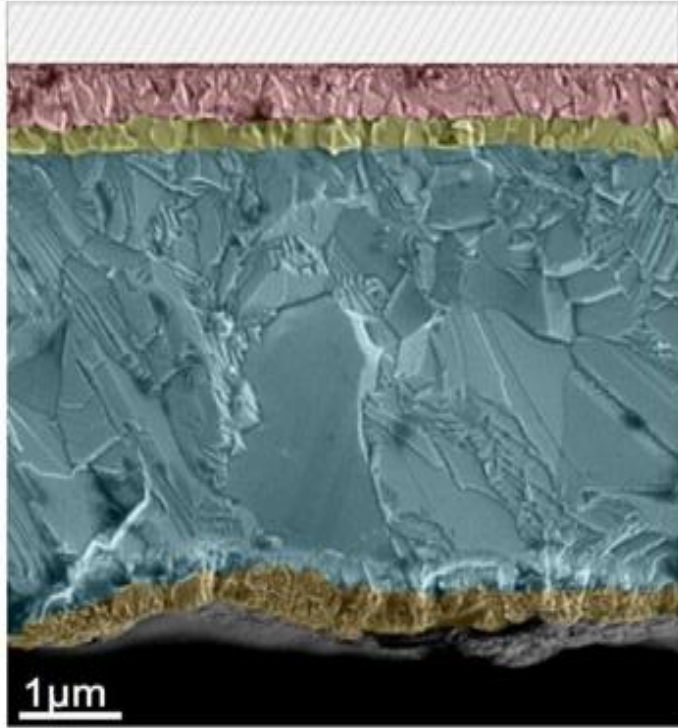
CdTe:



Abundance, atoms of element
per 10⁶ atoms of Si



Labscale CdTe solar cells



Glass
SnO₂
CdS

CdTe

ZnTe:Cu
Ti

First solar

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Voc ~ 852 mV

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