

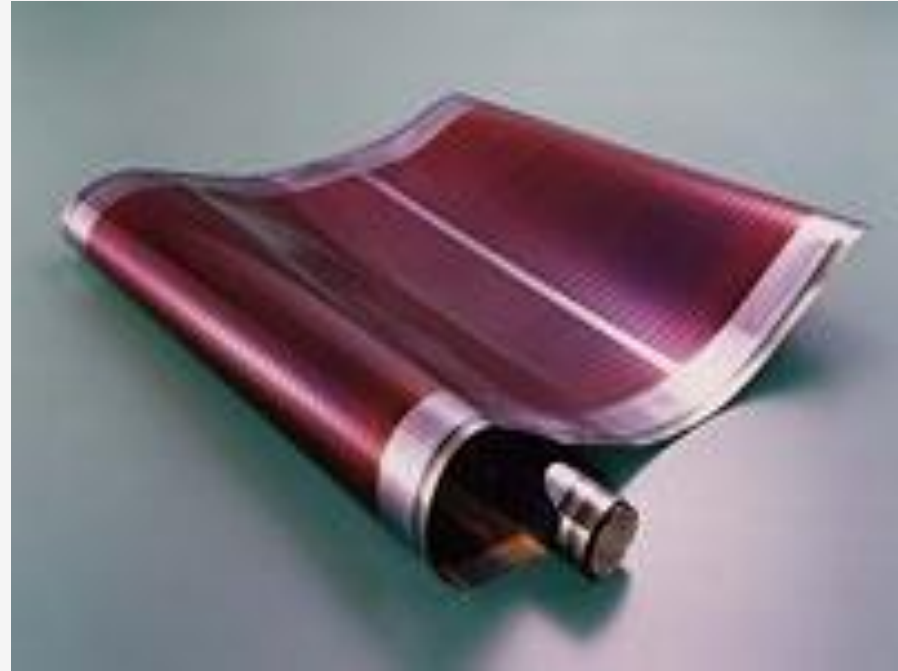
Thin-Film PV Technologies

Thin-Film Silicon PV Technology I

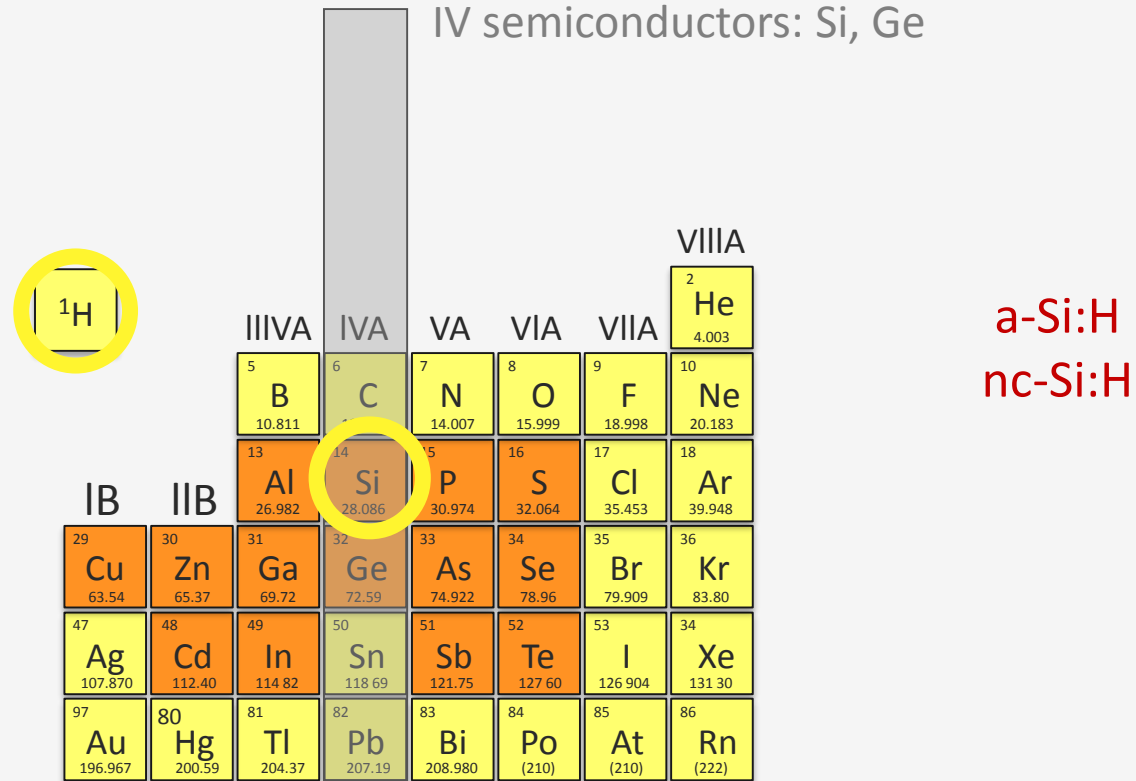
Week 5.2.1

Arno Smets

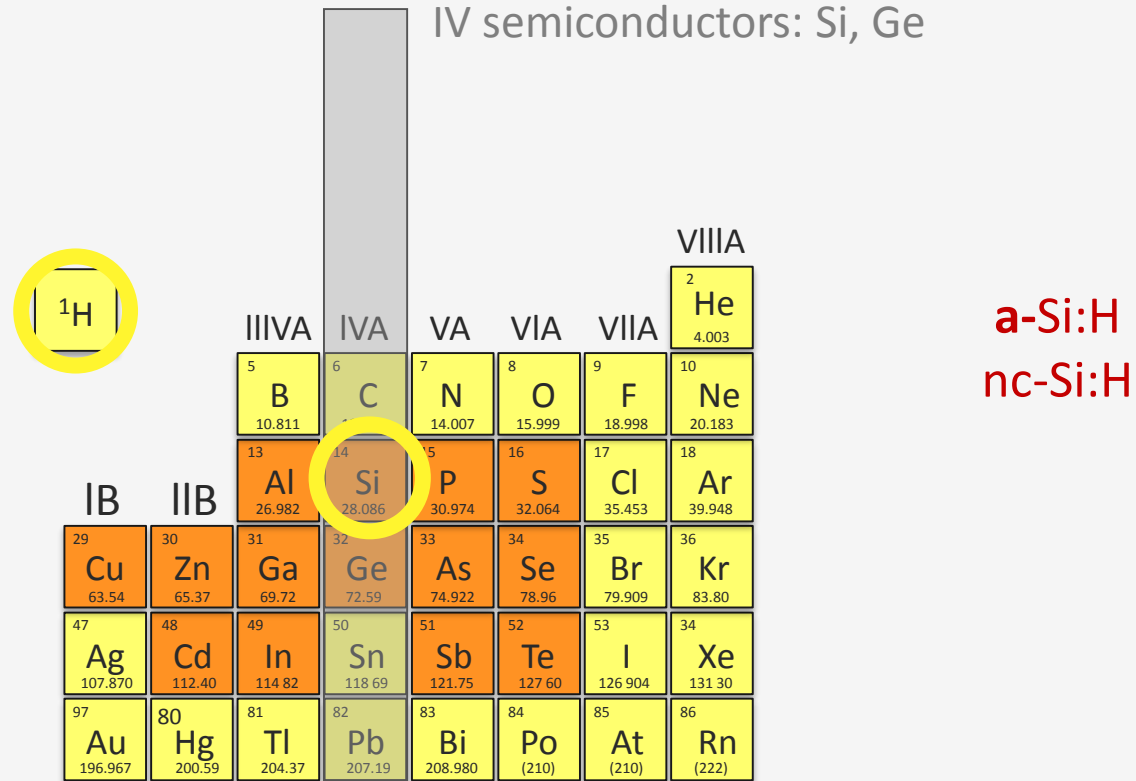
Thin film Silicon solar cell



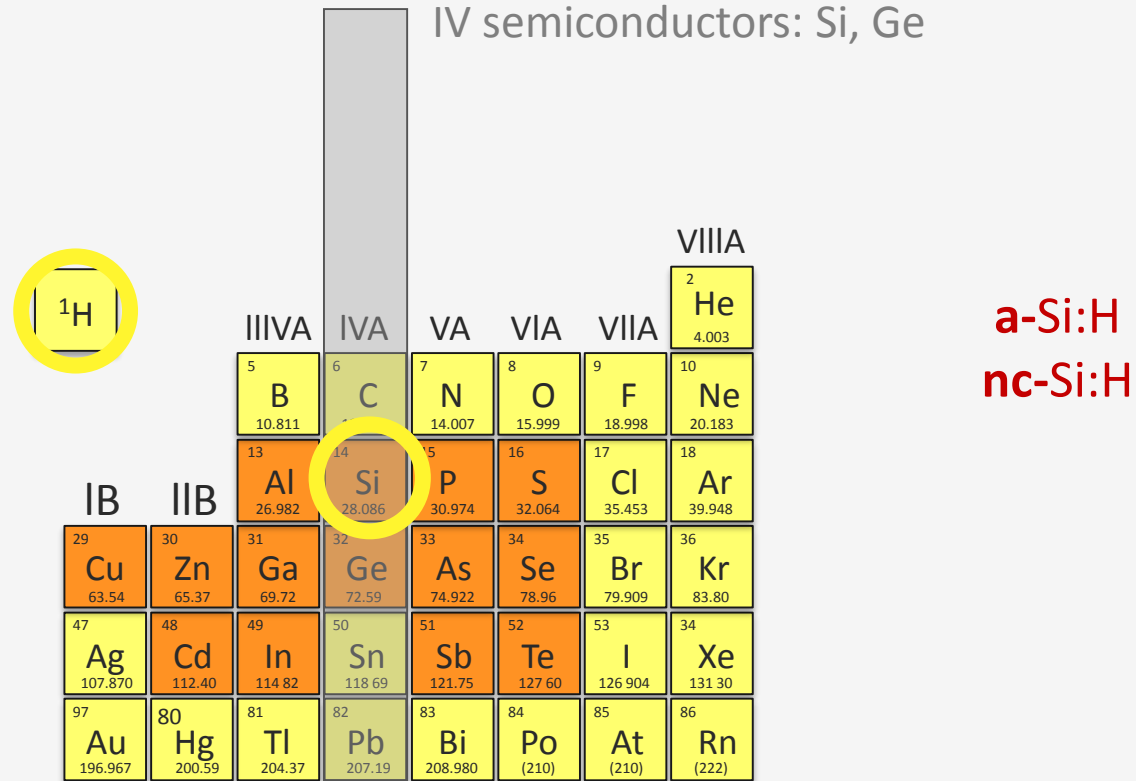
Semiconductor Materials



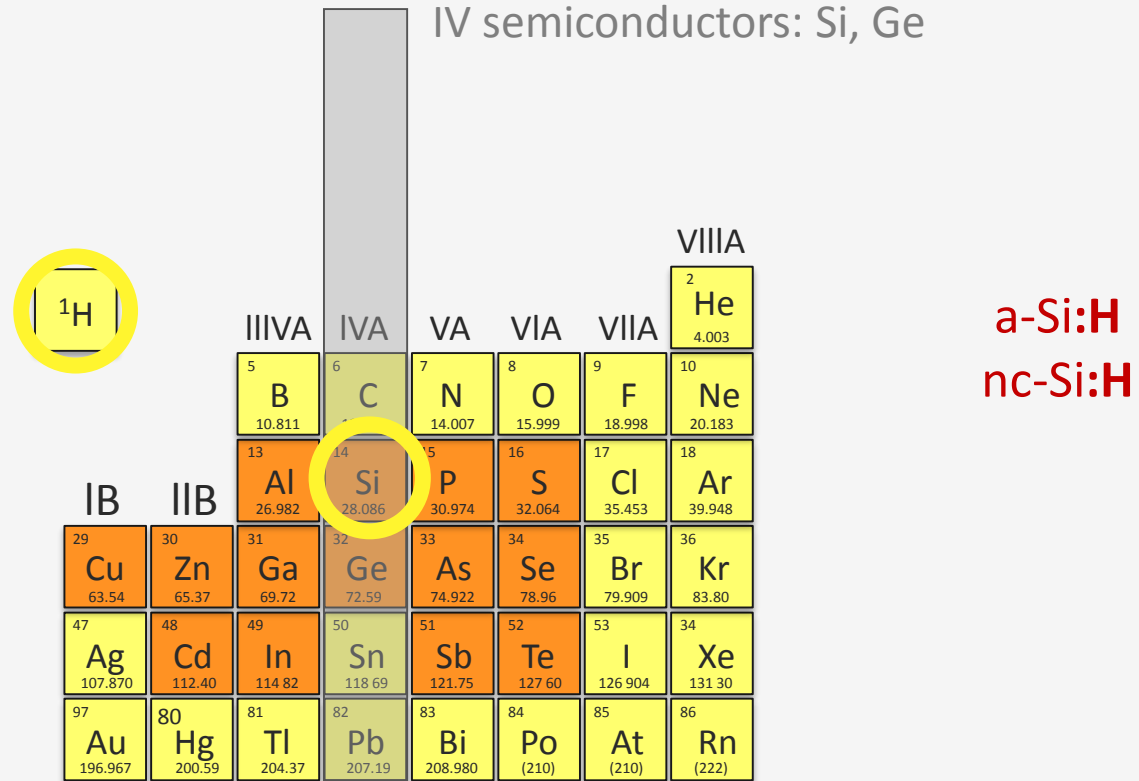
Semiconductor Materials



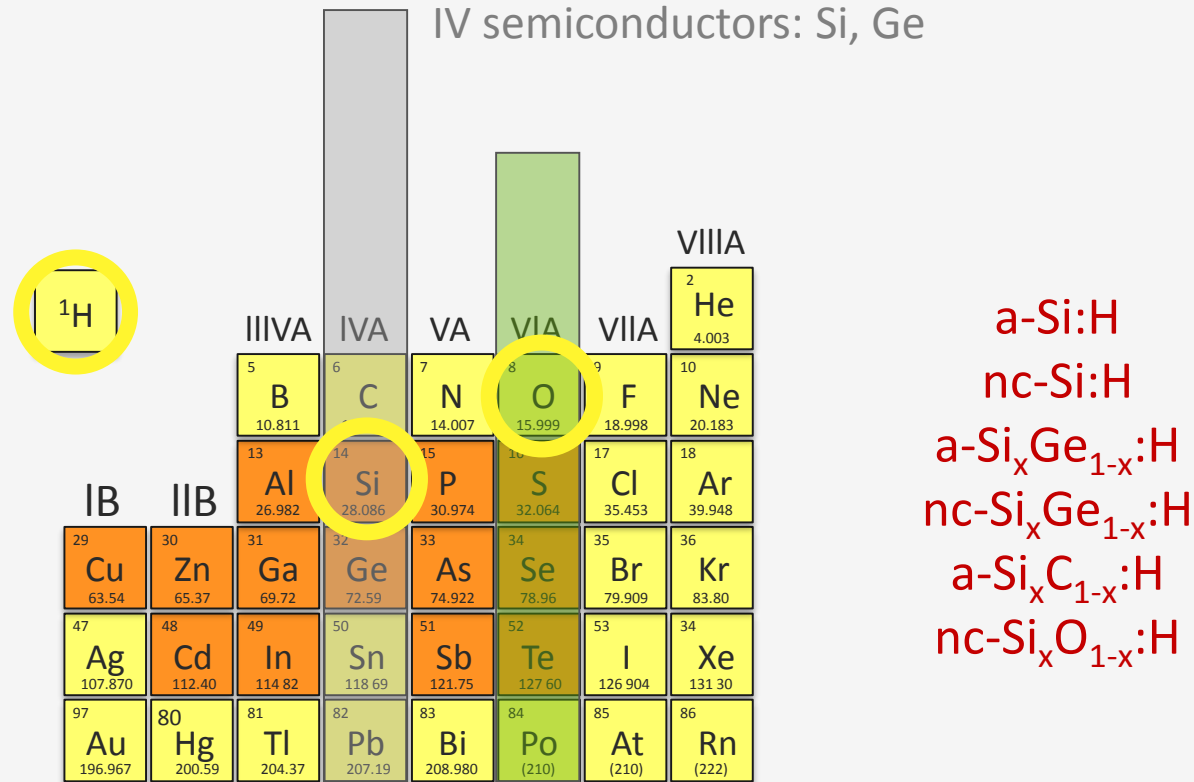
Semiconductor Materials



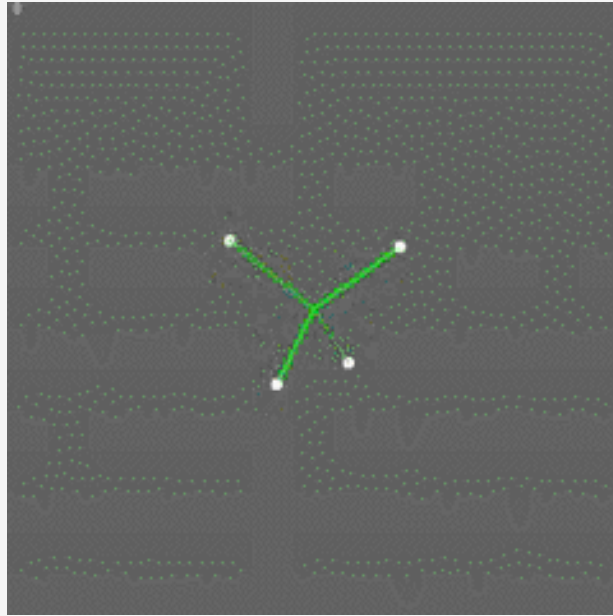
Semiconductor Materials



Semiconductor Materials



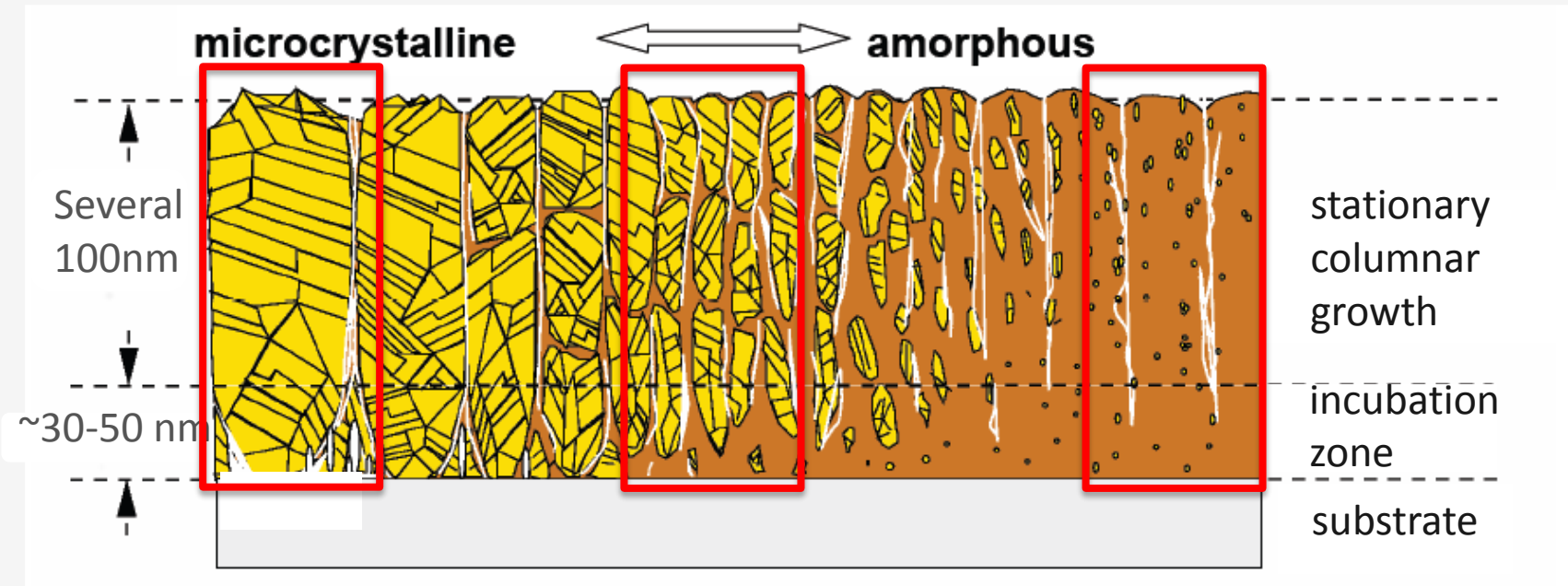
Amorphous Network



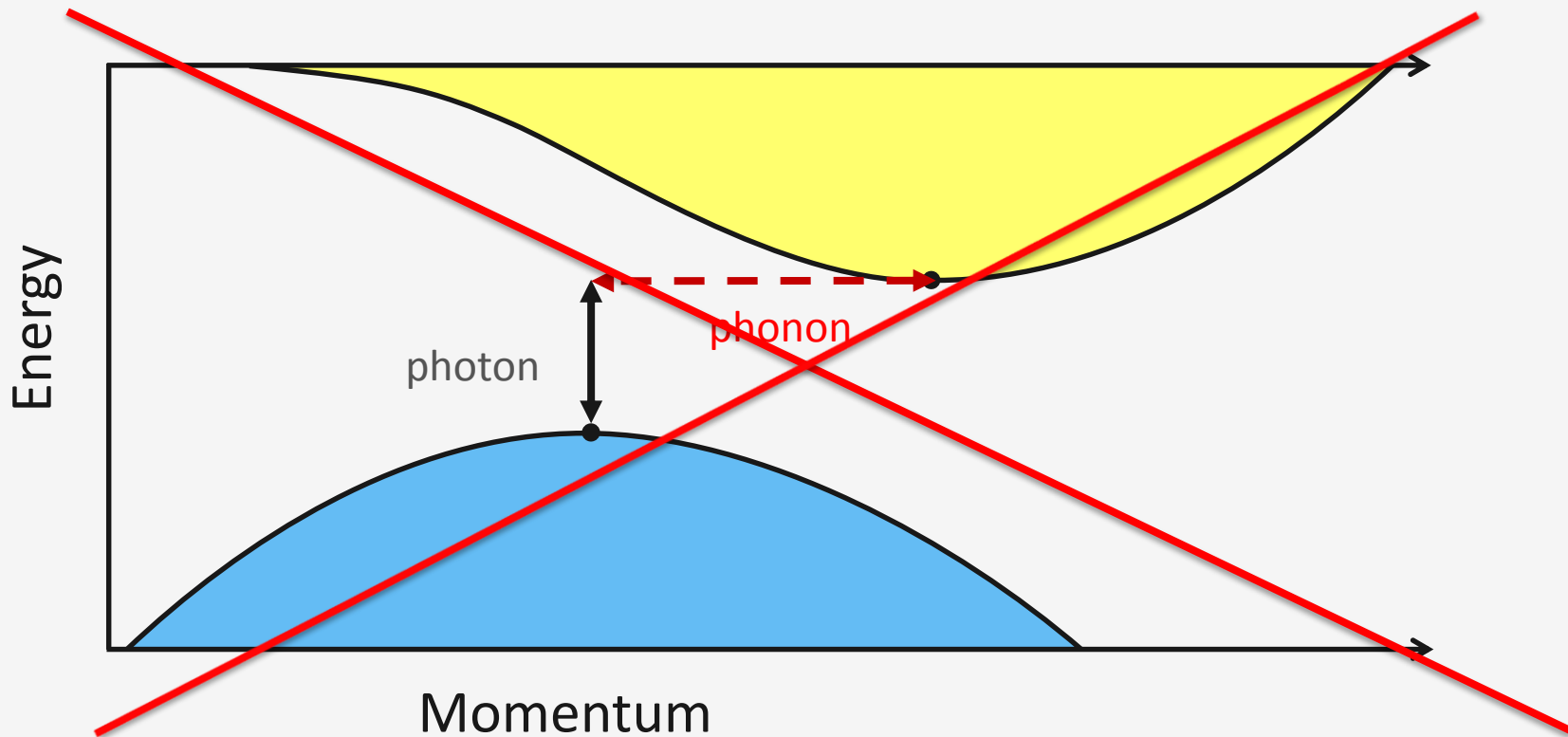
Source:

www.youtube.com/watch?v=OyVUmucwhPo

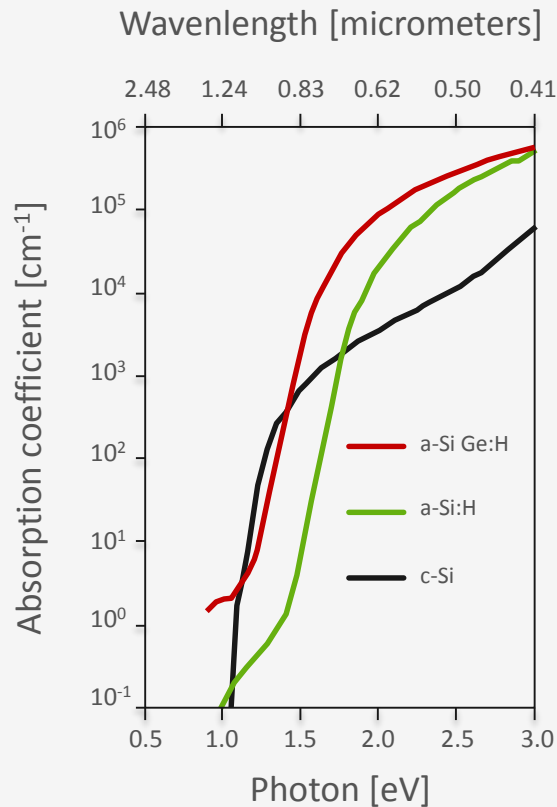
2 Material Phases: amorphous and microcrystalline silicon



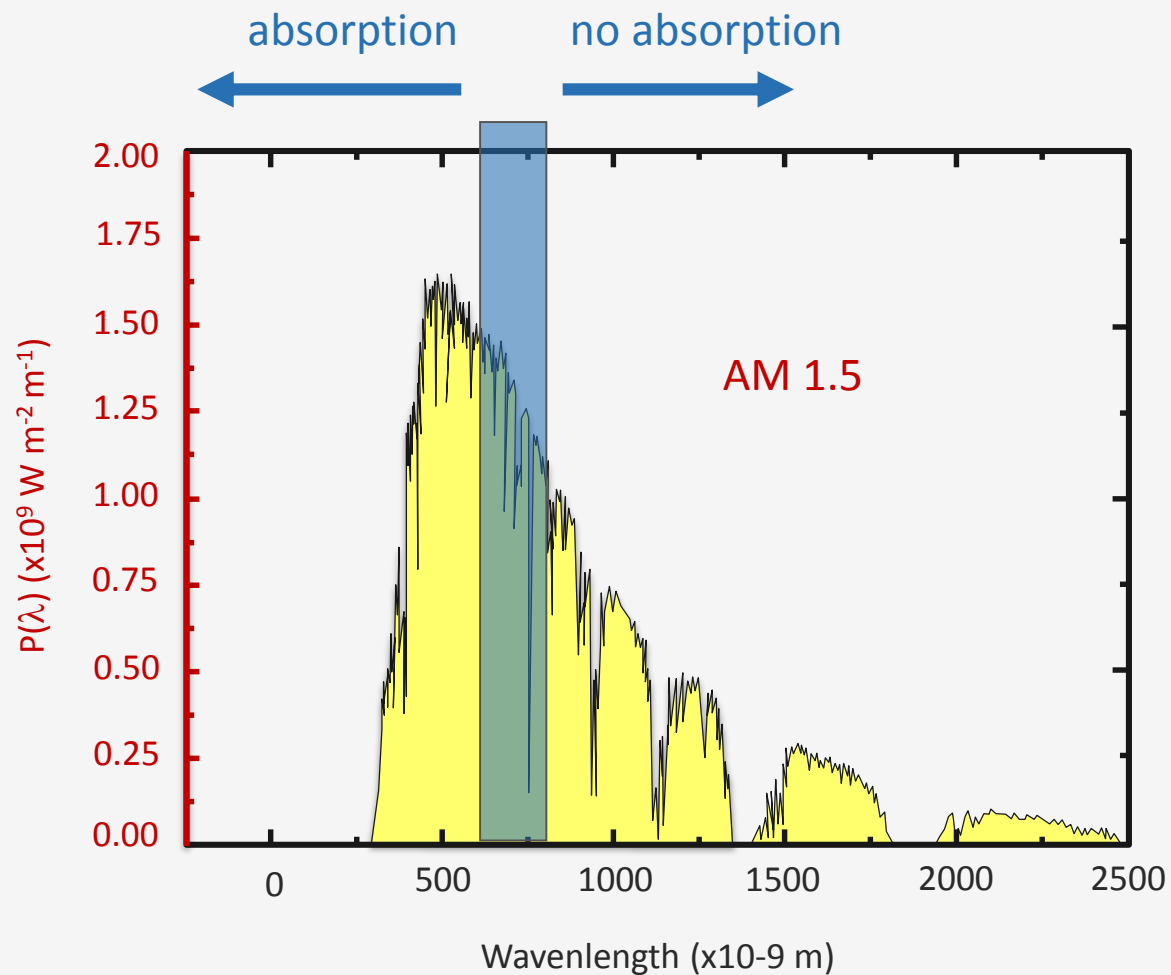
Indirect band gap



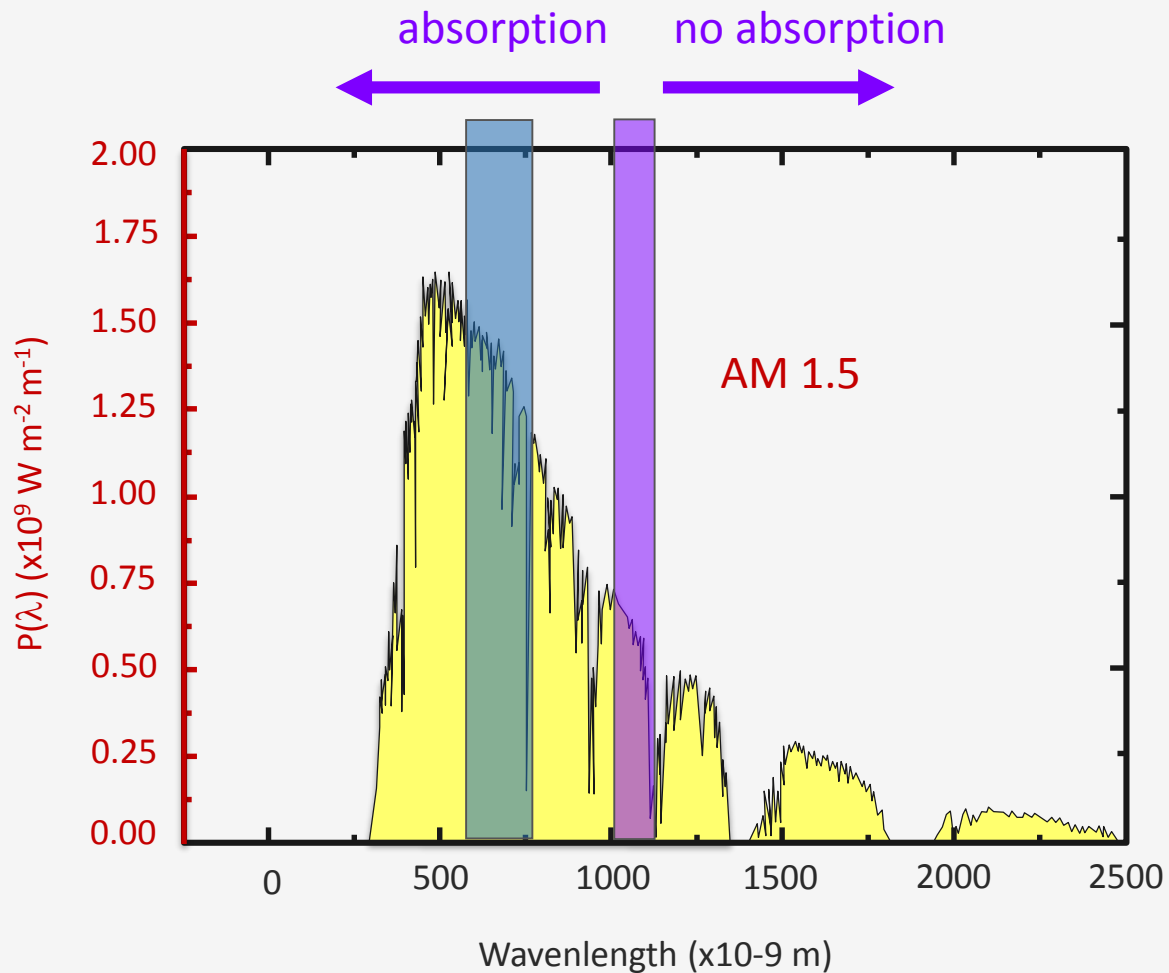
Comparison with c-Si: lattice



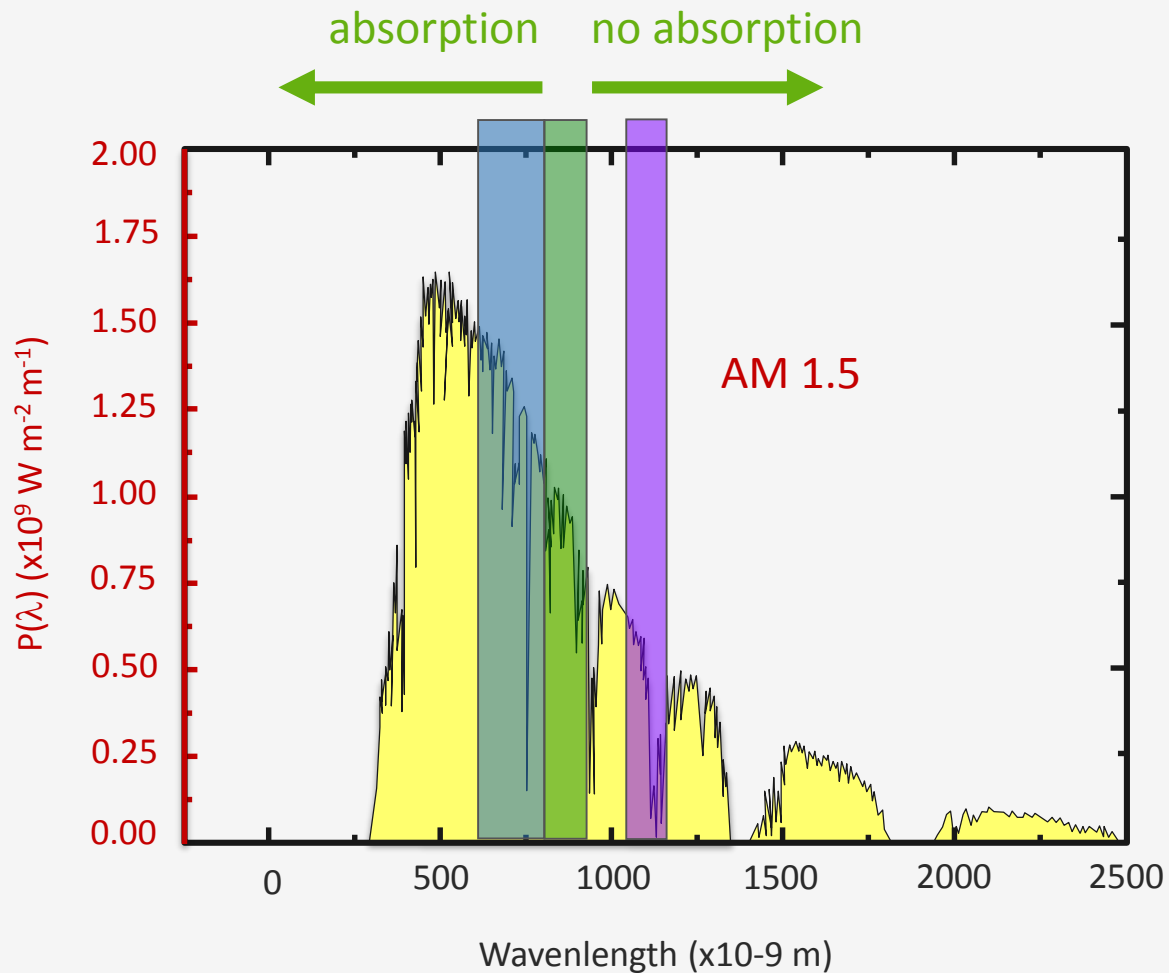
alloy	Band gap
a-Si:H	1.6-1.9 eV



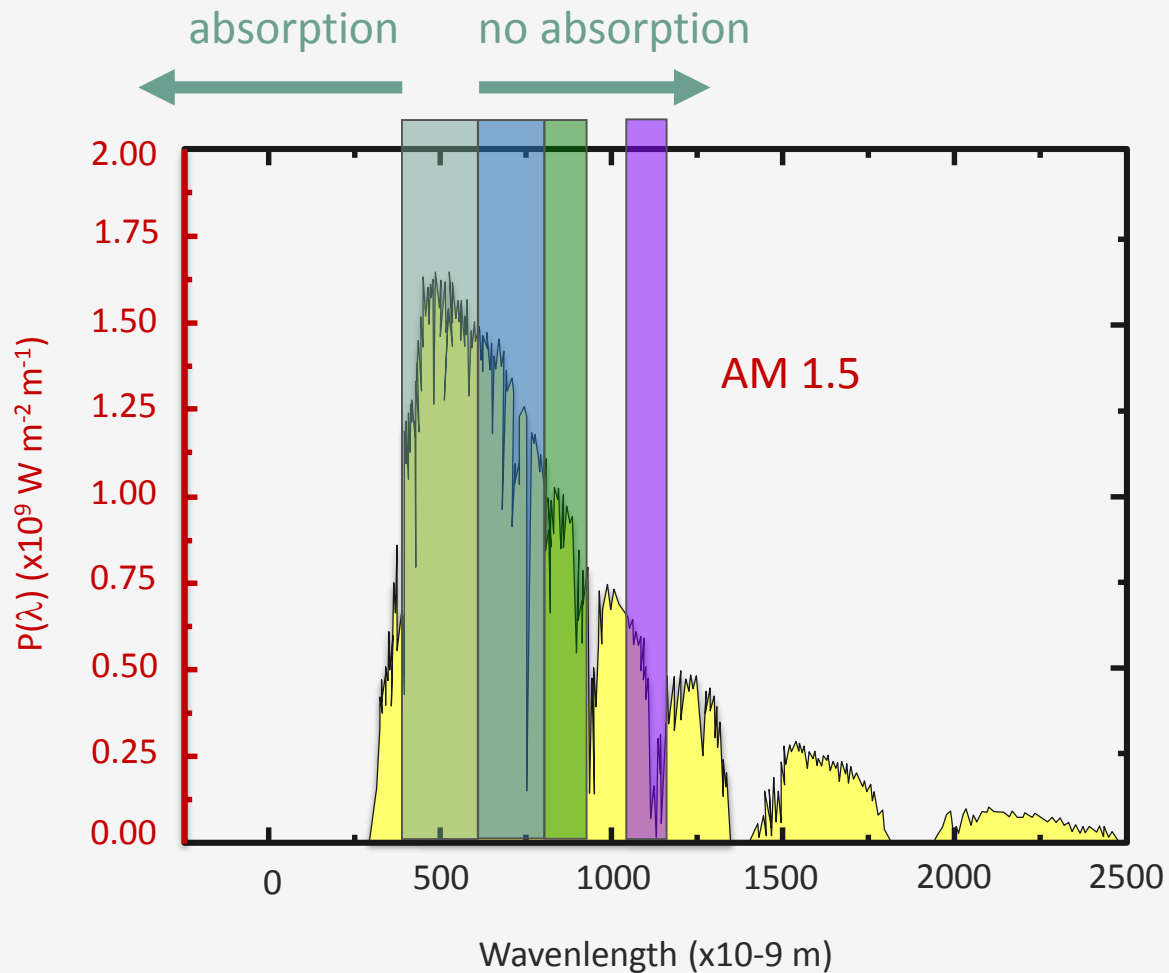
alloy	Band gap
a-Si:H	1.6-1.9 eV
nc-Si:H	1.1-1.3 eV



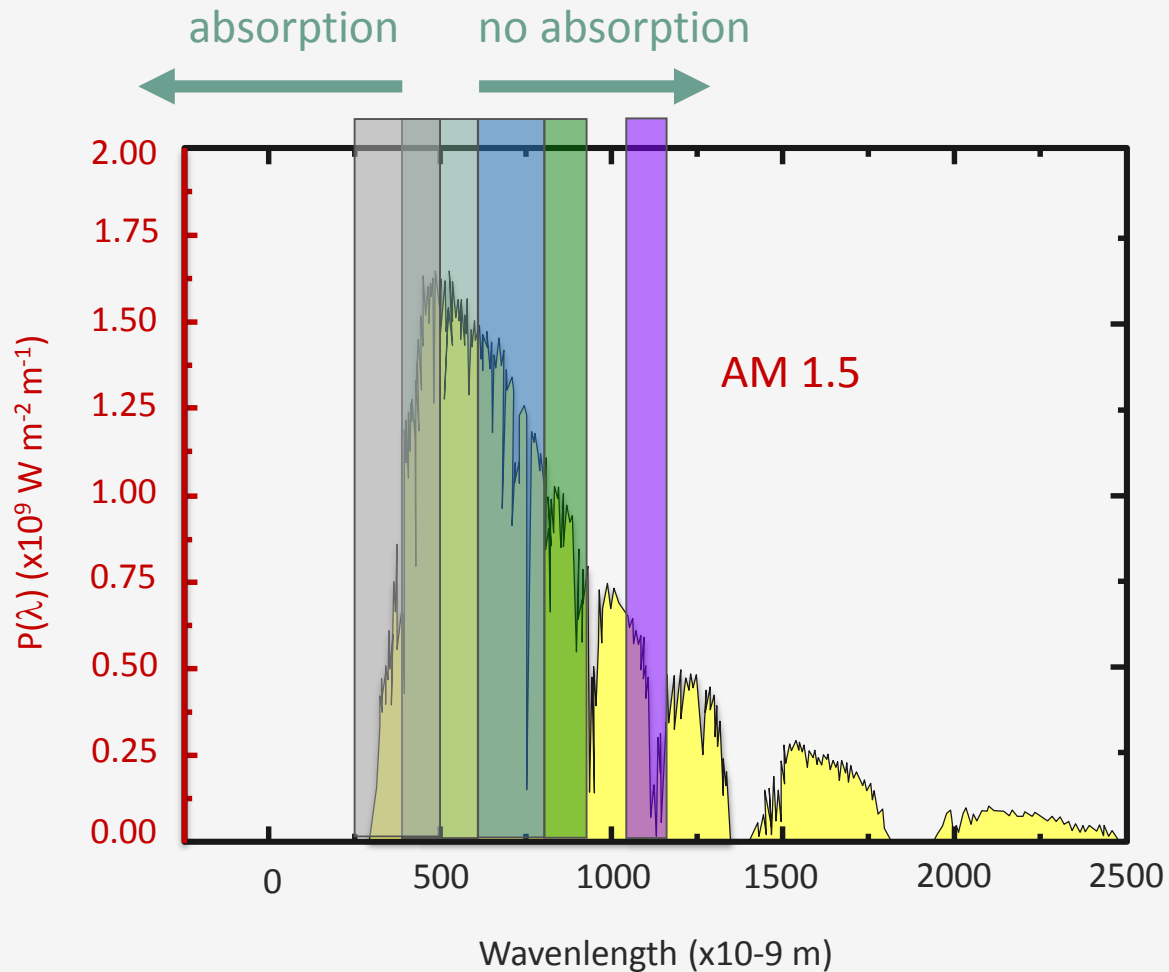
alloy	Band gap
a-Si:H	1.6-1.9 eV
nc-Si:H	1.1-1.3 eV
a-SiGe:H	1.4-1.6 eV



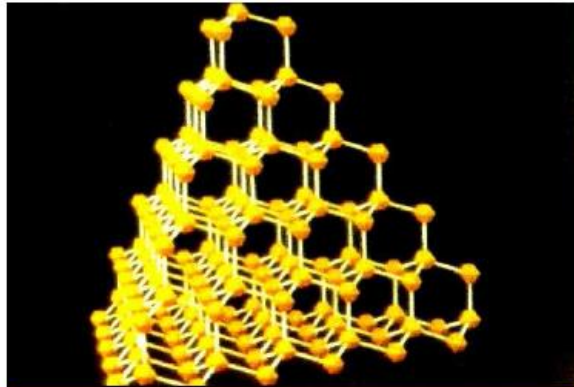
alloy	Band gap
a-Si:H	1.6-1.9 eV
nc-Si:H	1.1-1.3 eV
a-SiGe:H	1.4-1.6 eV
a-SiC:H	>1.9 eV



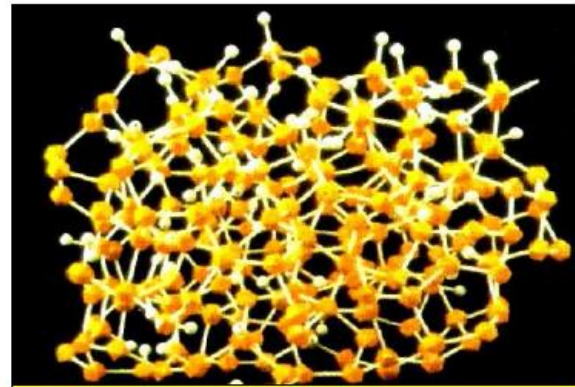
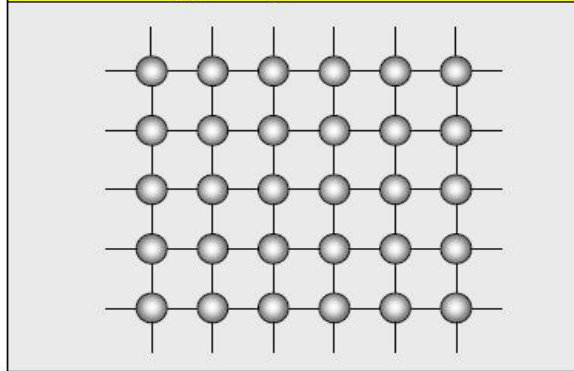
alloy	Band gap
a-Si:H	1.6-1.9 eV
nc-Si:H	1.1-1.3 eV
a-SiGe:H	1.4-1.6 eV
a-SiC:H	>1.9 eV
nc-SiO:H	>2.0 eV



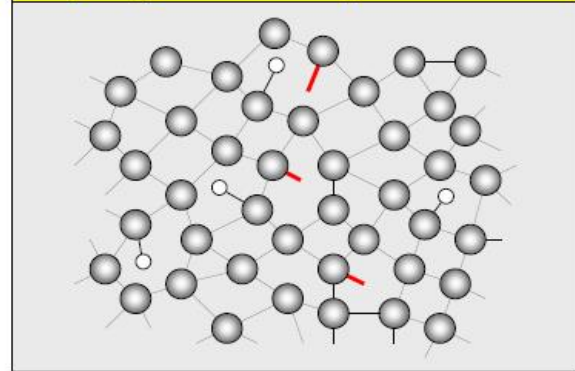
Defects in the lattice



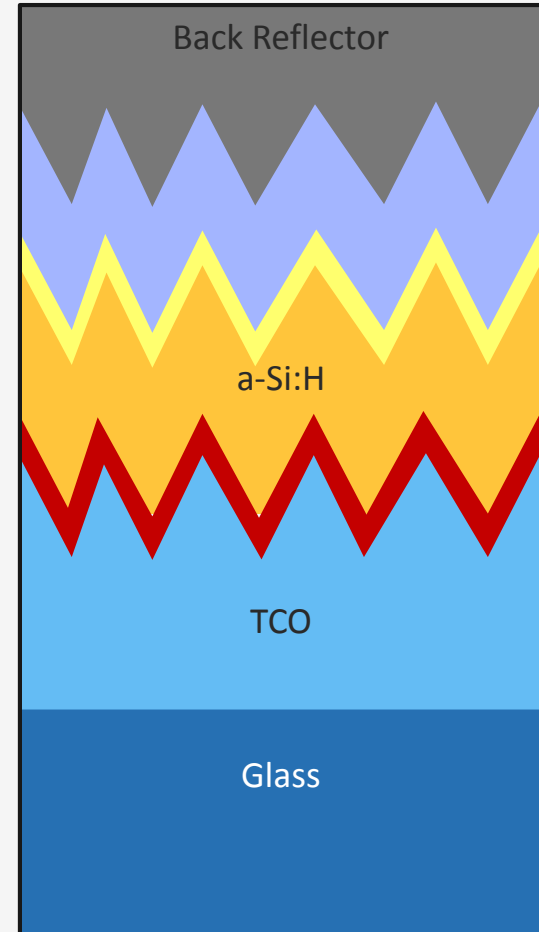
Single crystal silicon



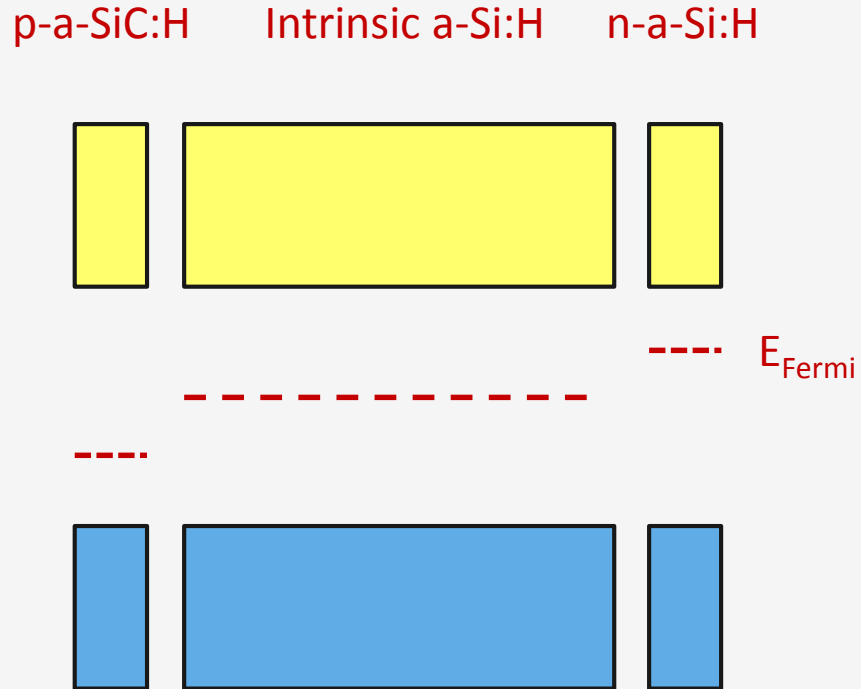
Hydrogenated amorphous silicon



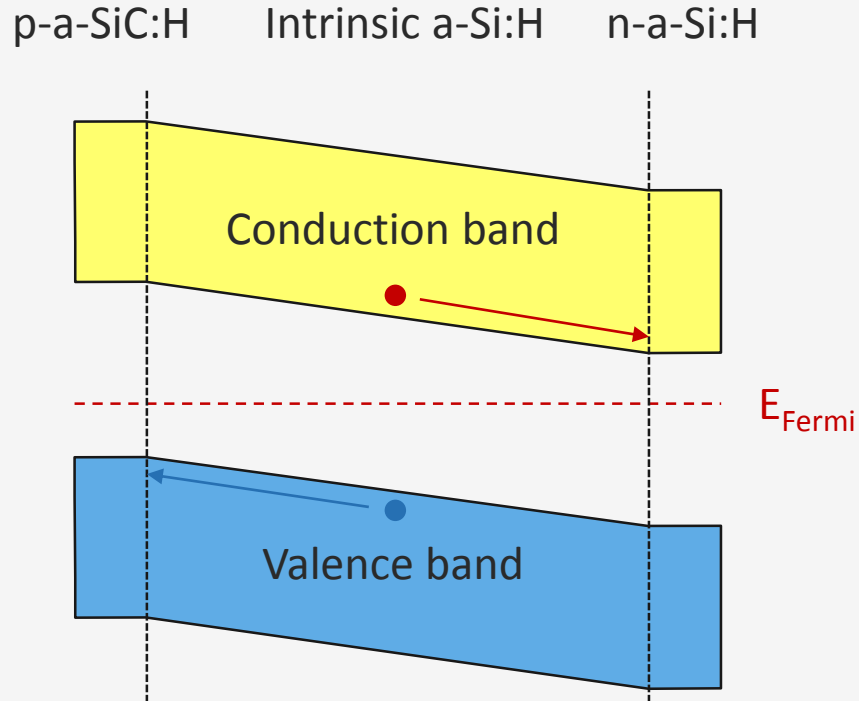
An a-Si:H p-i-n junction



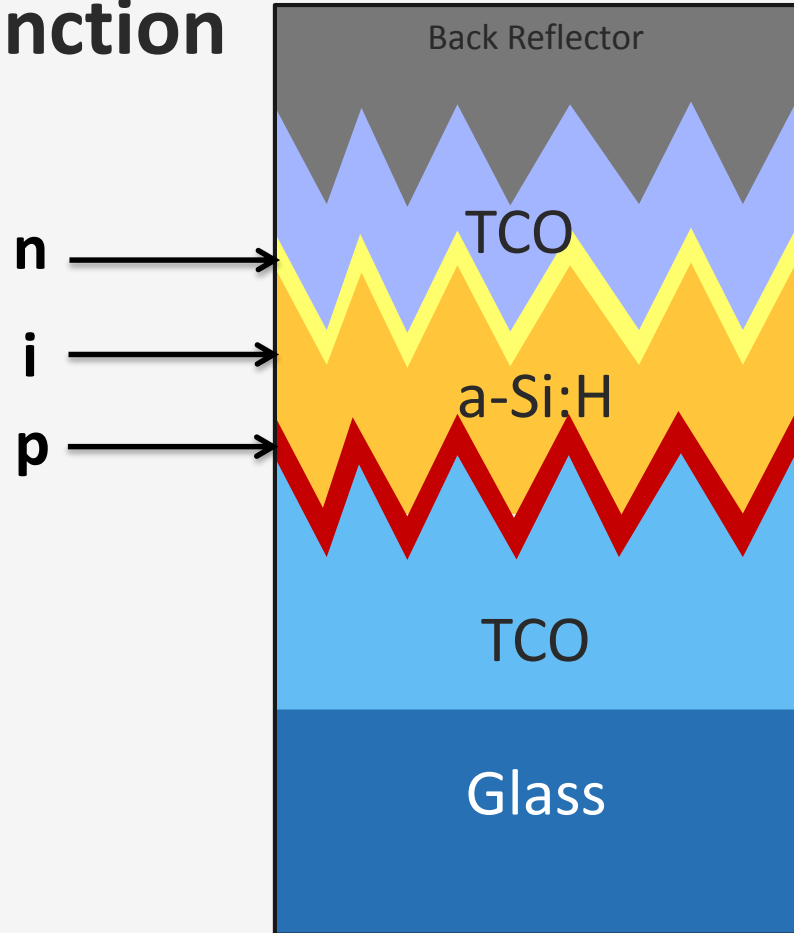
a-Si:H: drift mechanism required for transport



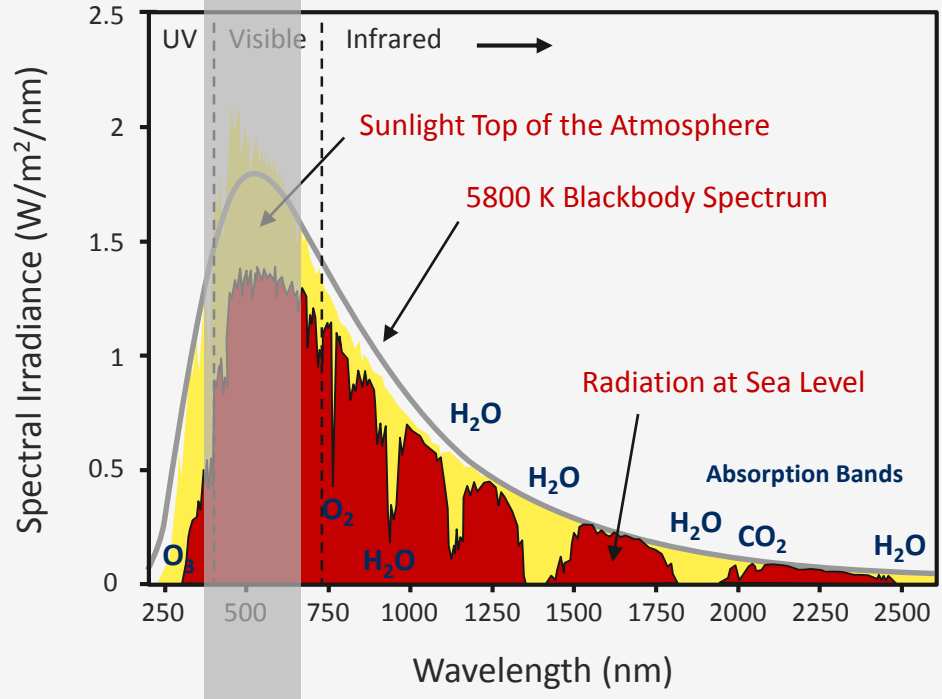
Principle of a-Si:H p-i-n junction



A typical a-Si:H p-i-n junction

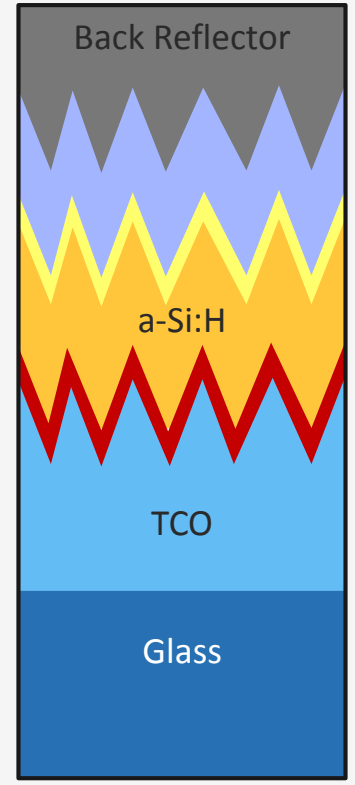


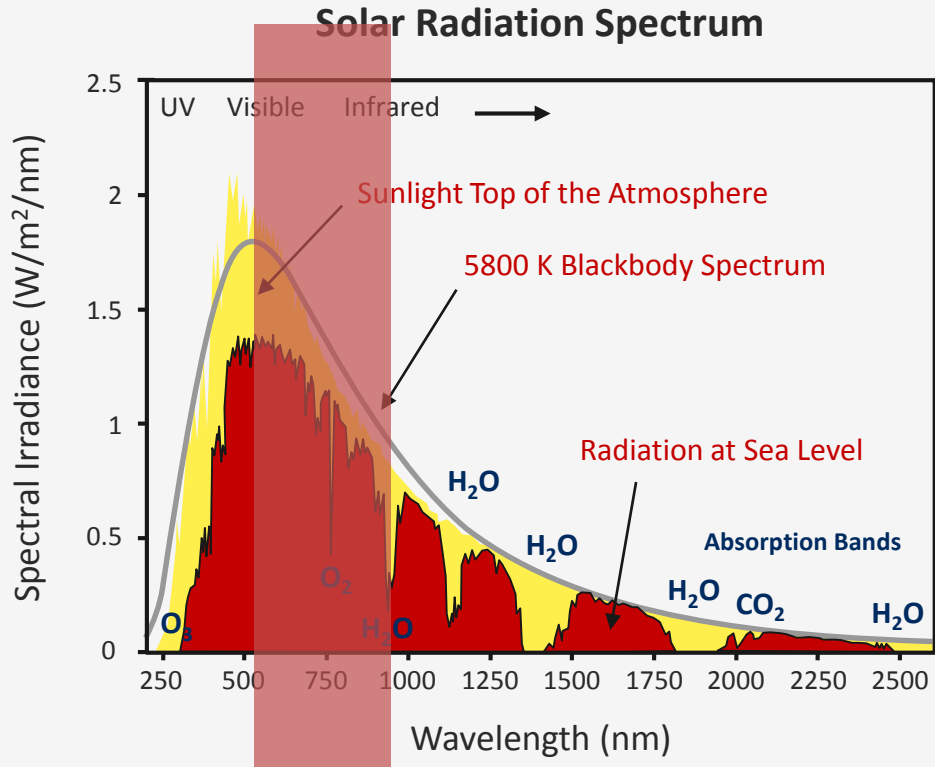
Solar Radiation Spectrum



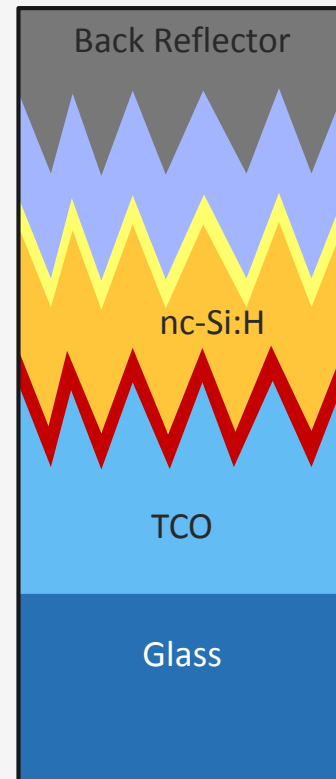
Absorption
a-Si:H

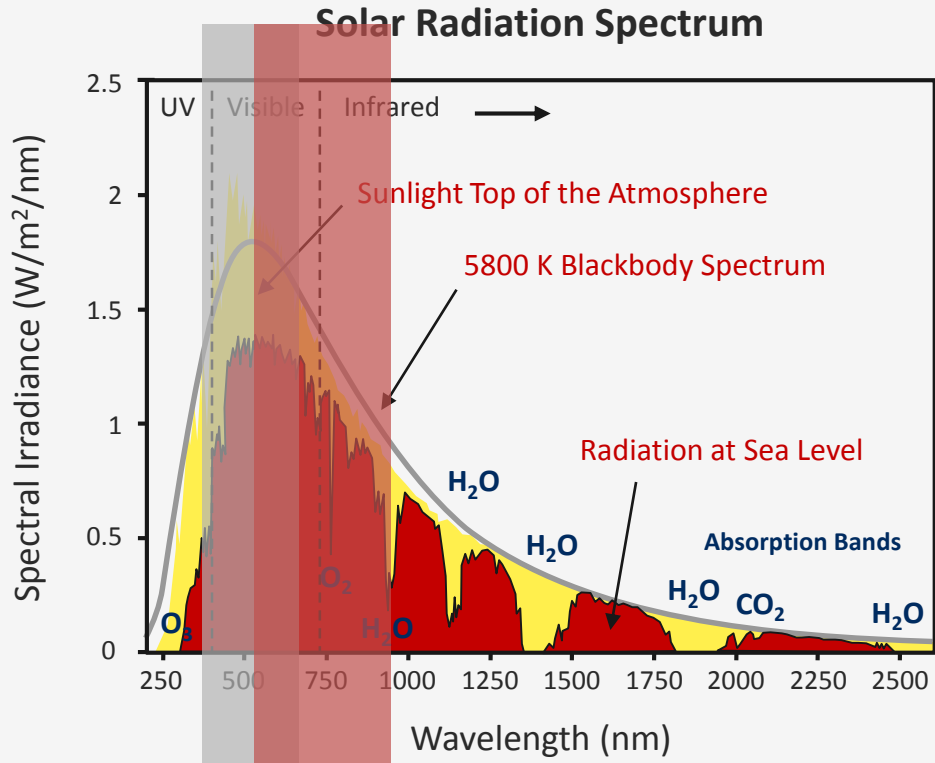
Does not cover entire spectrum!





Absorption
nc-Si:H
 Does not cover entire spectrum!





Absorption
A-Si:H

Absorption
nc-Si:H
Better spectrum coverage!

