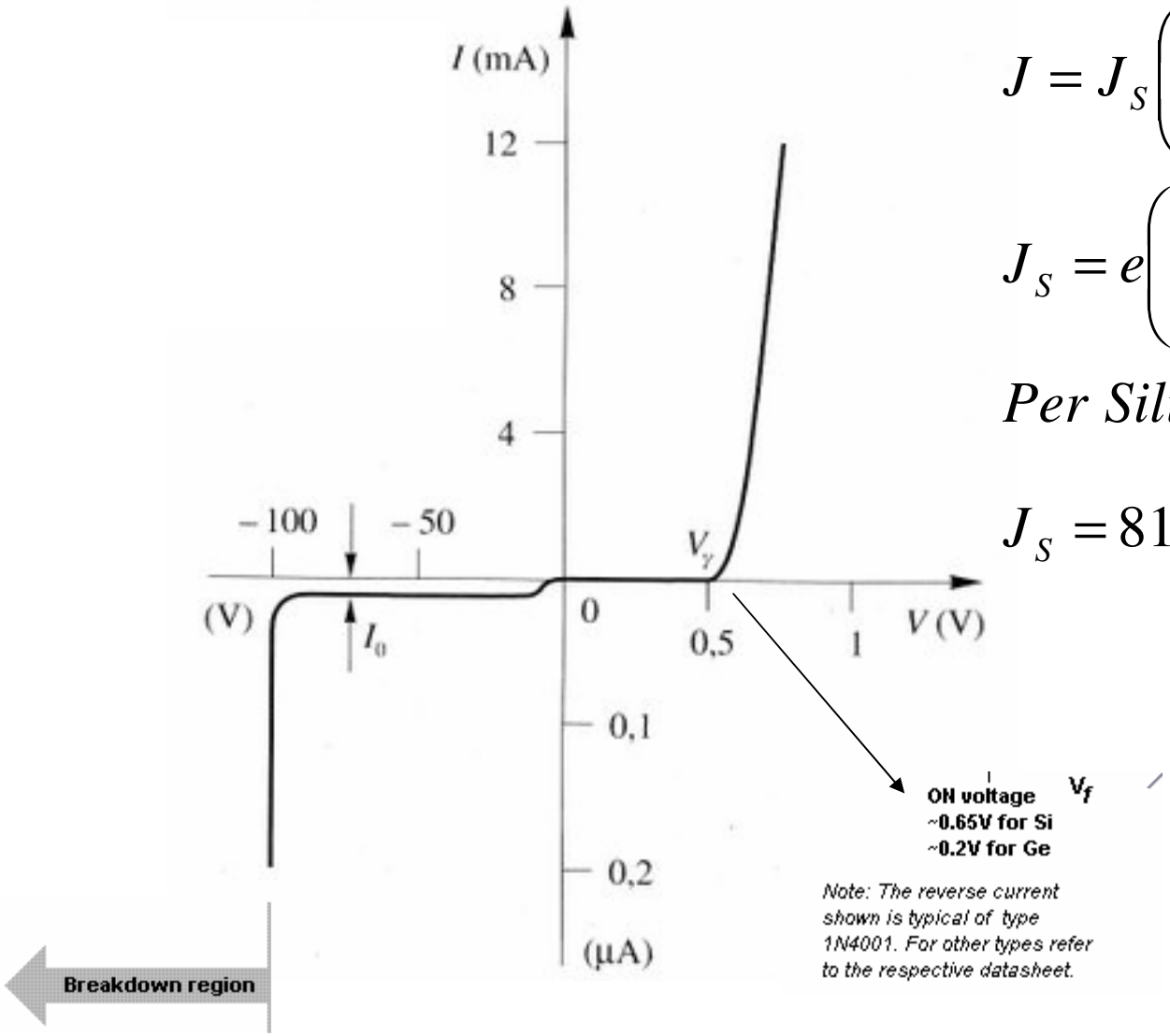
Legge di Shockley



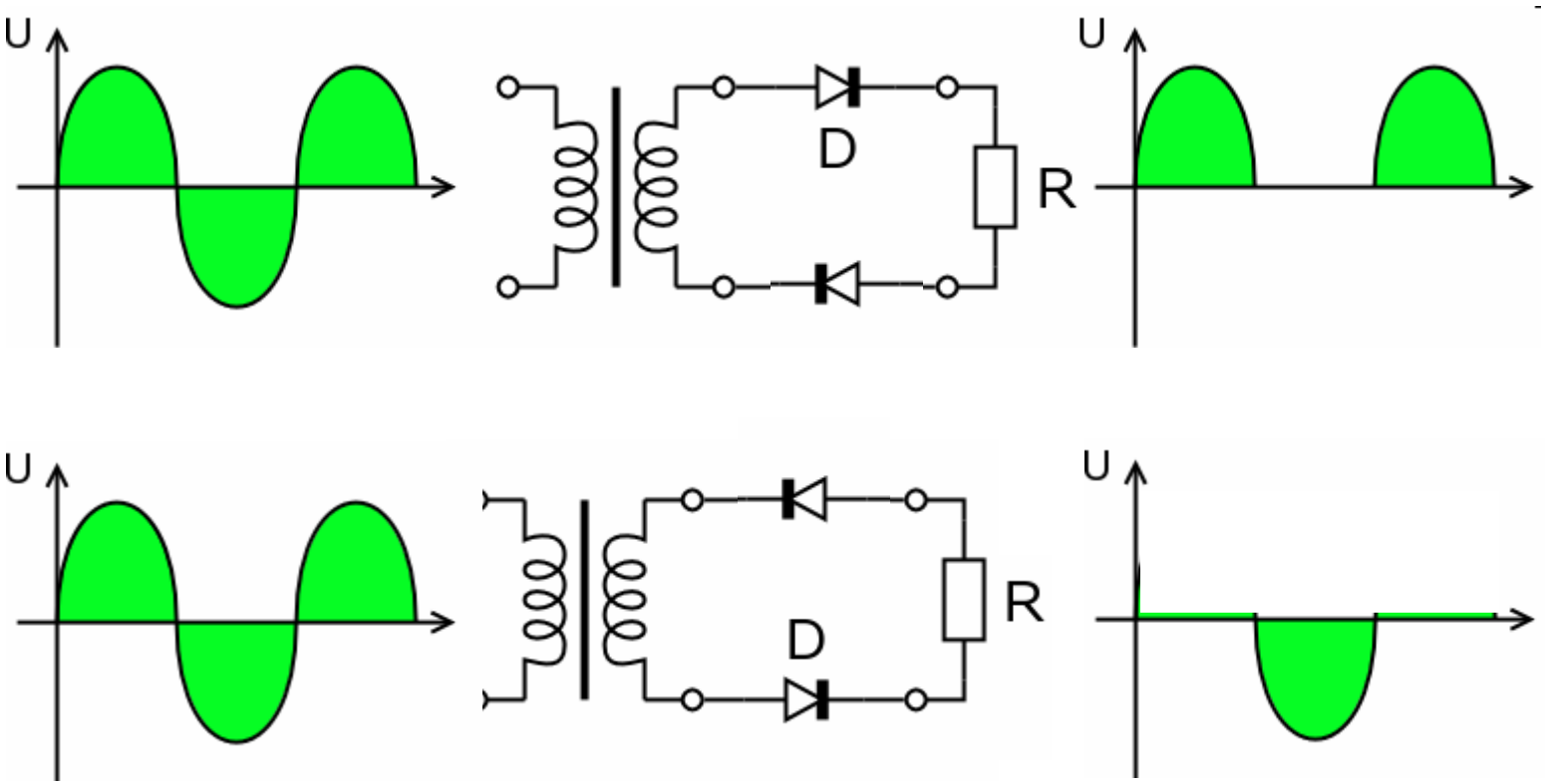
$$J = J_S\left(\exp\left(\frac{eV}{KT}\right)-1\right)$$

$$J_S = e\left(\frac{n_i^2}{N_A}\frac{D_e}{L_e}+\frac{n_i^2}{N_D}\frac{D_h}{L_h}\right)$$

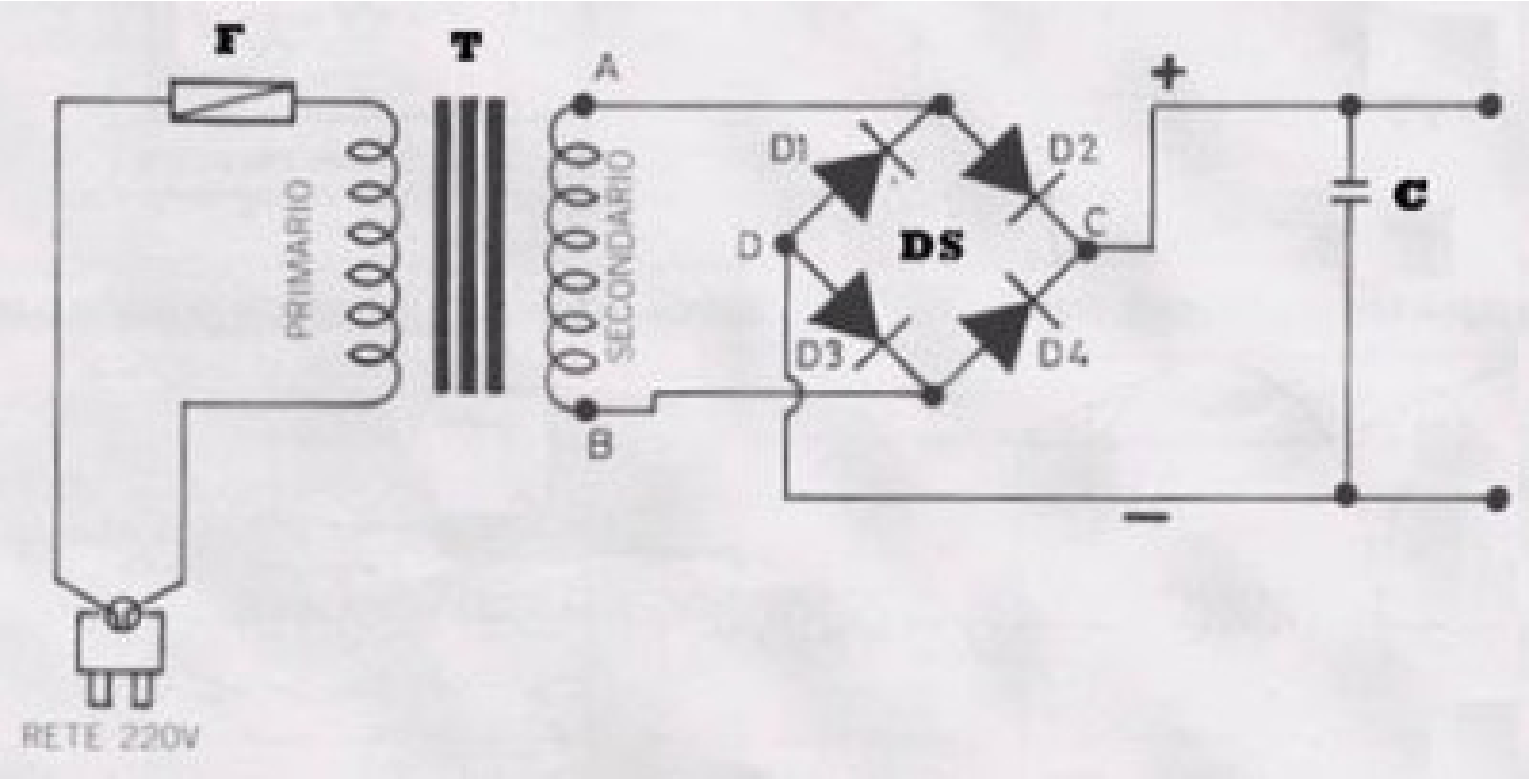
Per Silicio

$$J_S = 810^{-8}\,\frac{Amp}{m^2}$$

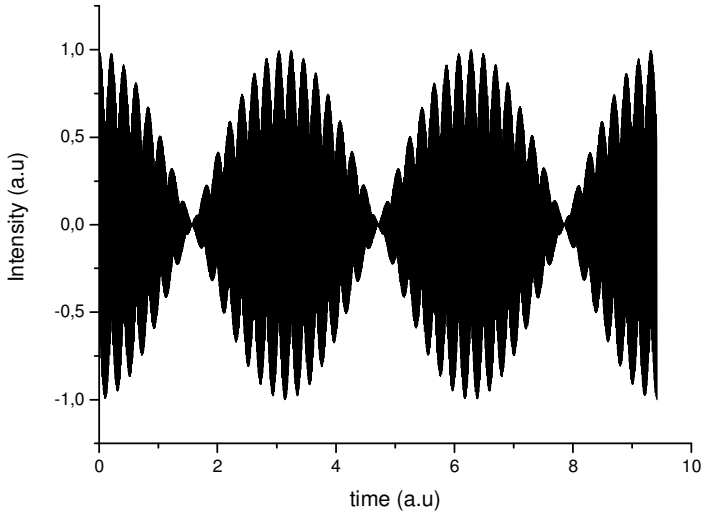
Raddrizzatore

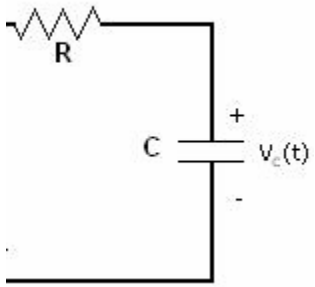


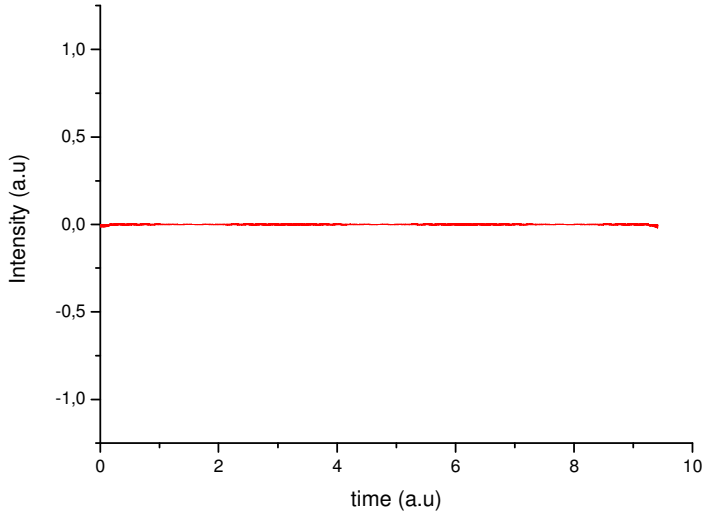
Alimentatore cw



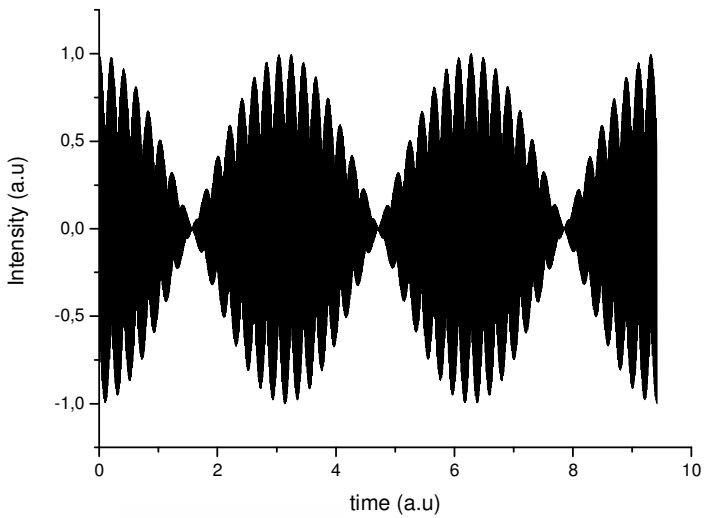
Demodulatore AM

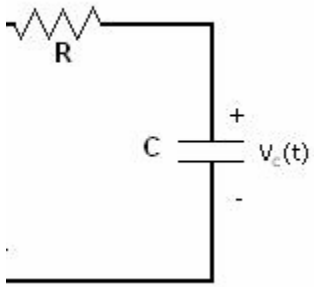


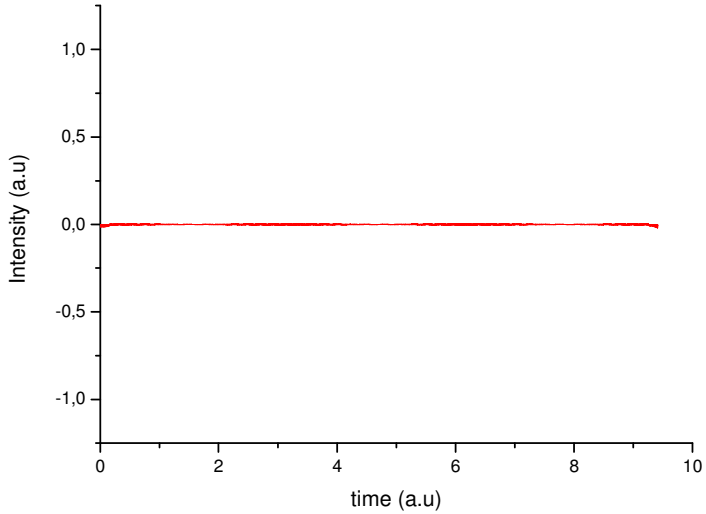


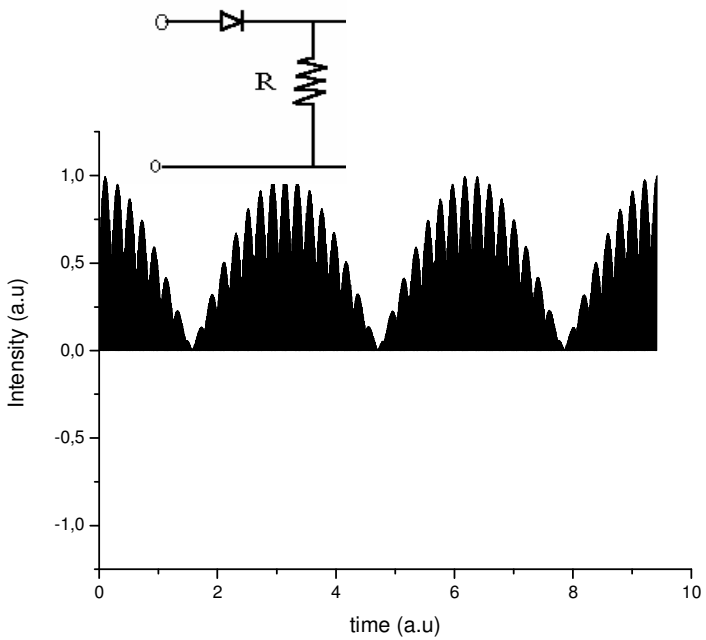


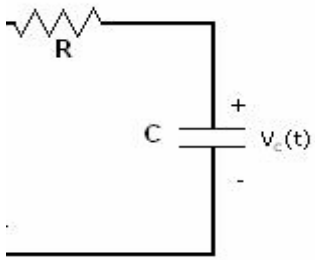
Demodulatore AM

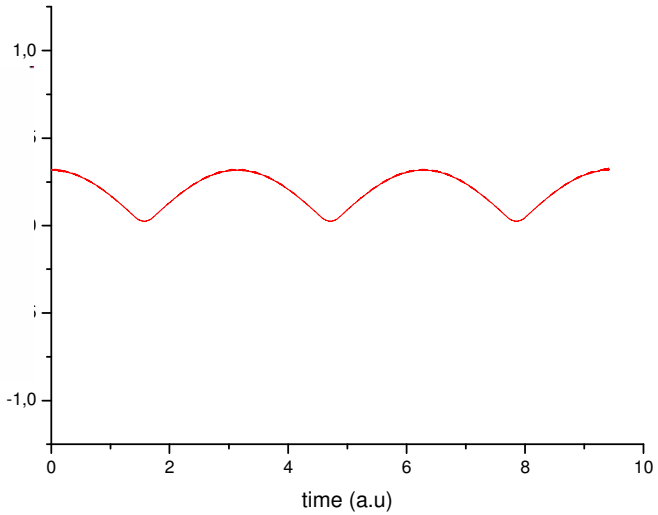




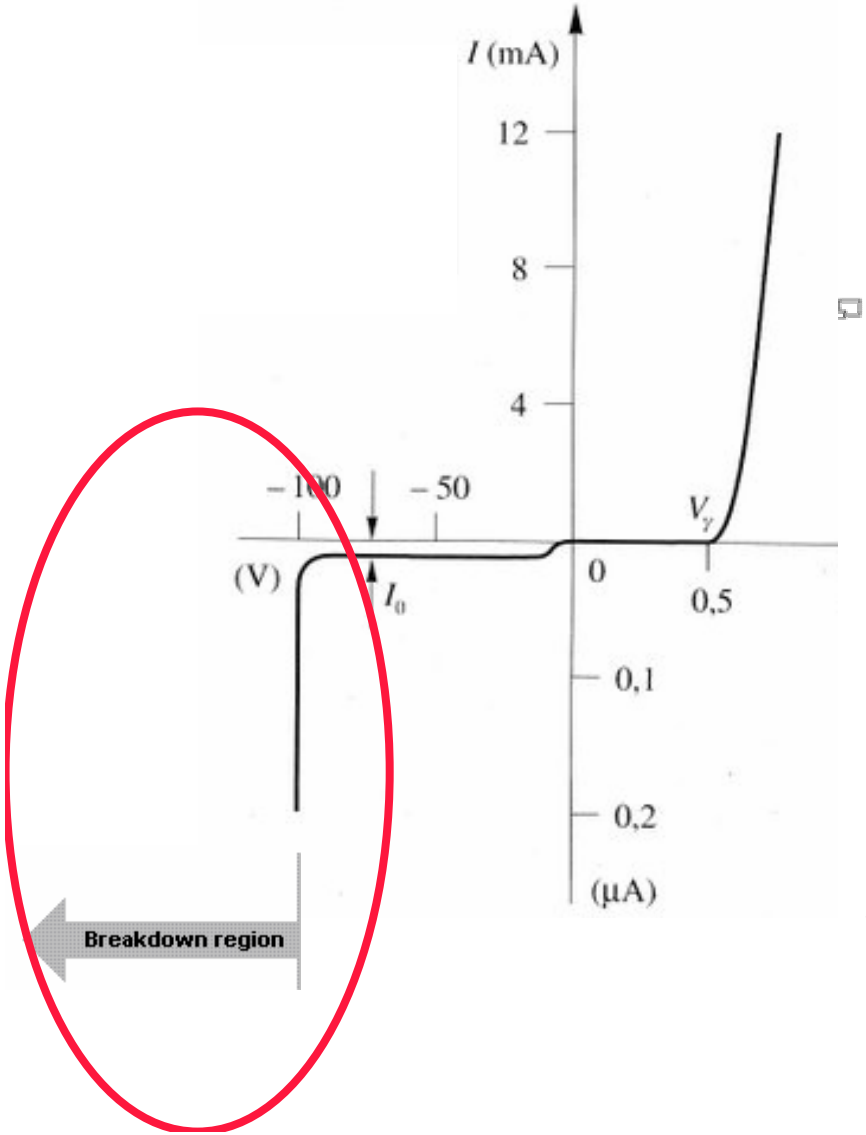


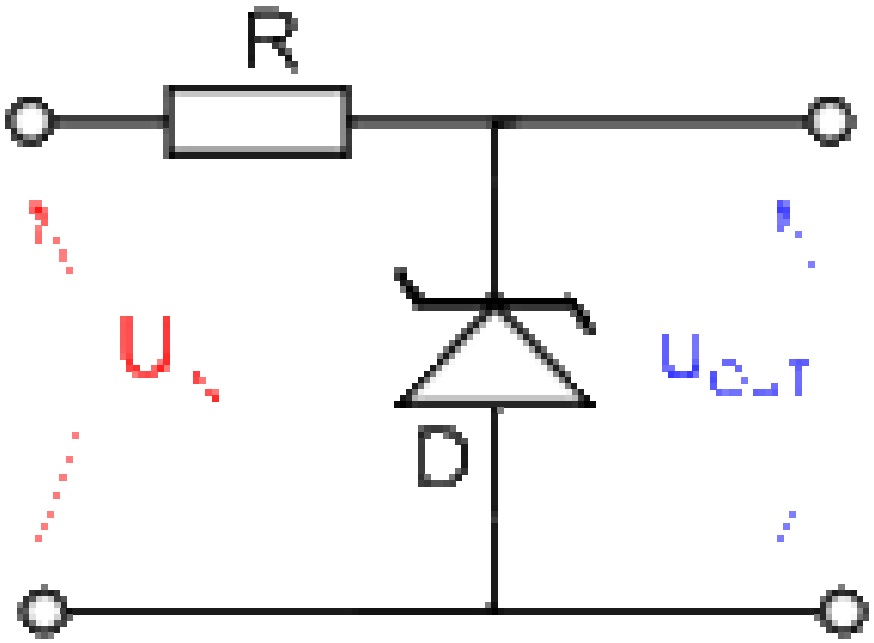






Diodo Zener: stabilizzatore di tensione

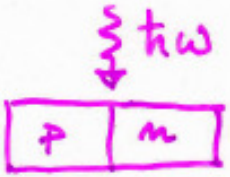




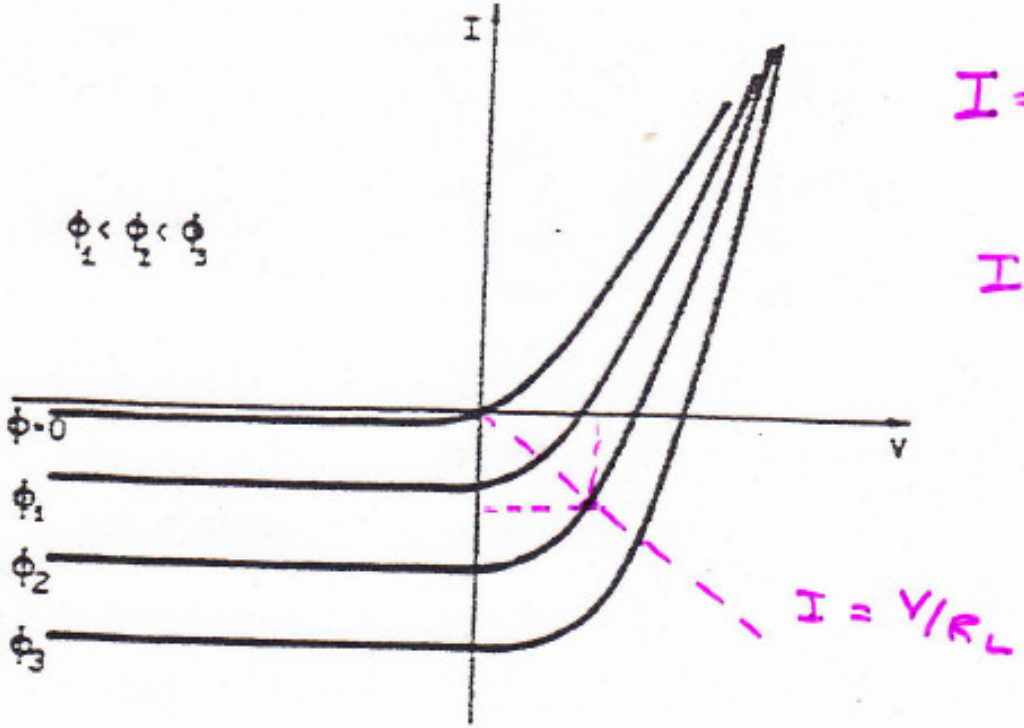
Se $U_{in} > V_{zener} \rightarrow U_{out} = U_{in}$

Se $U_{in} < V_{zener} \rightarrow U_{out} = V_{zener}$

Cella solare

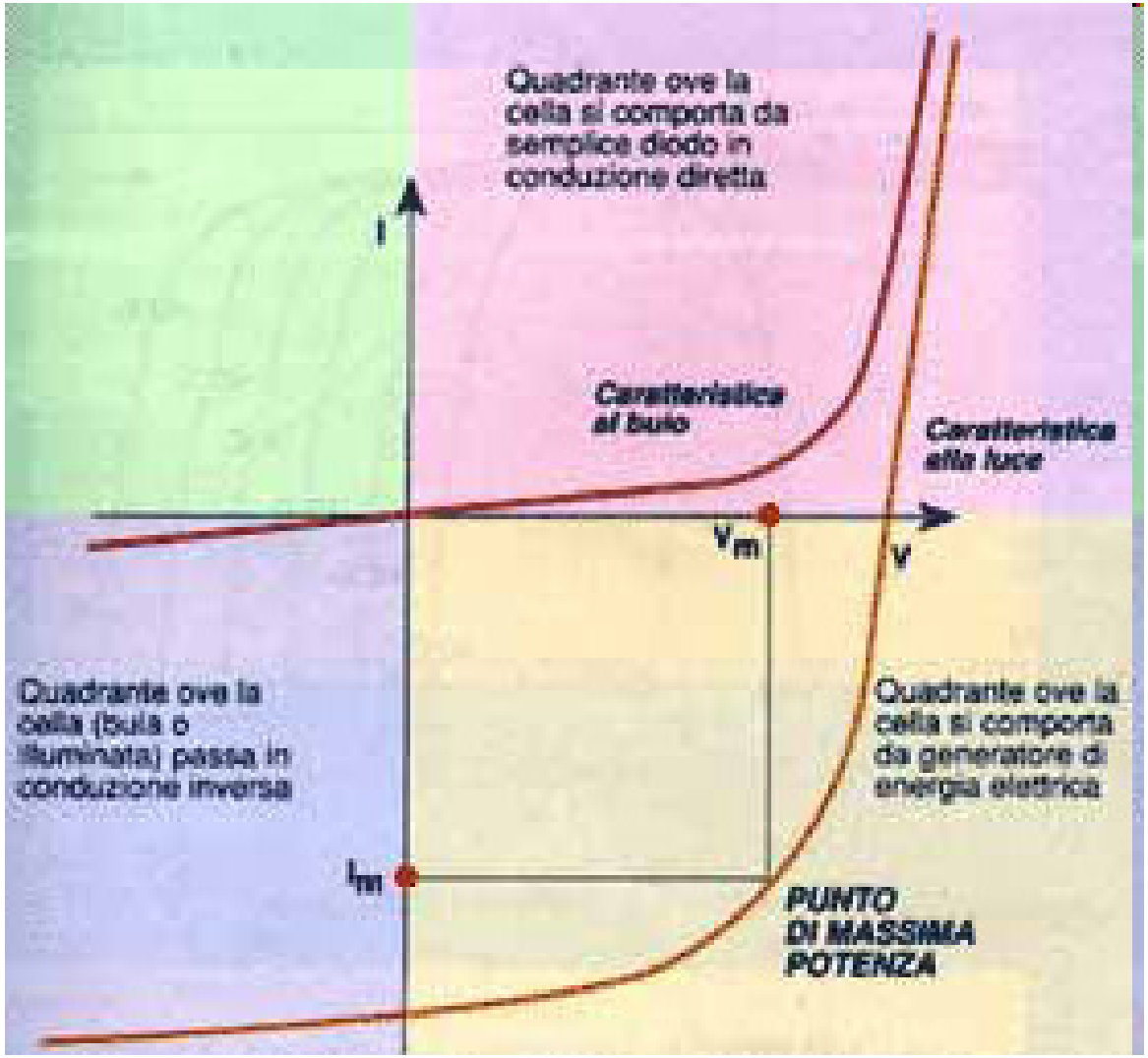


Φ = flusso luminoso



$$I = I_s\left(e^{\frac{eV}{kT}} - 1\right) - I_L$$

$$I_L \propto \Phi$$


Quadrante ove la cella si comporta da semplice diodo in conduzione diretta
I
Caratteristica al buio
Caratteristica alla luce
V_m
V
Quadrante ove la cella (buia o illuminata) passa in conduzione inversa
Quadrante ove la cella si comporta da generatore di energia elettrica
I_m
PUNTO DI MASSIMA POTENZA

Cella solare

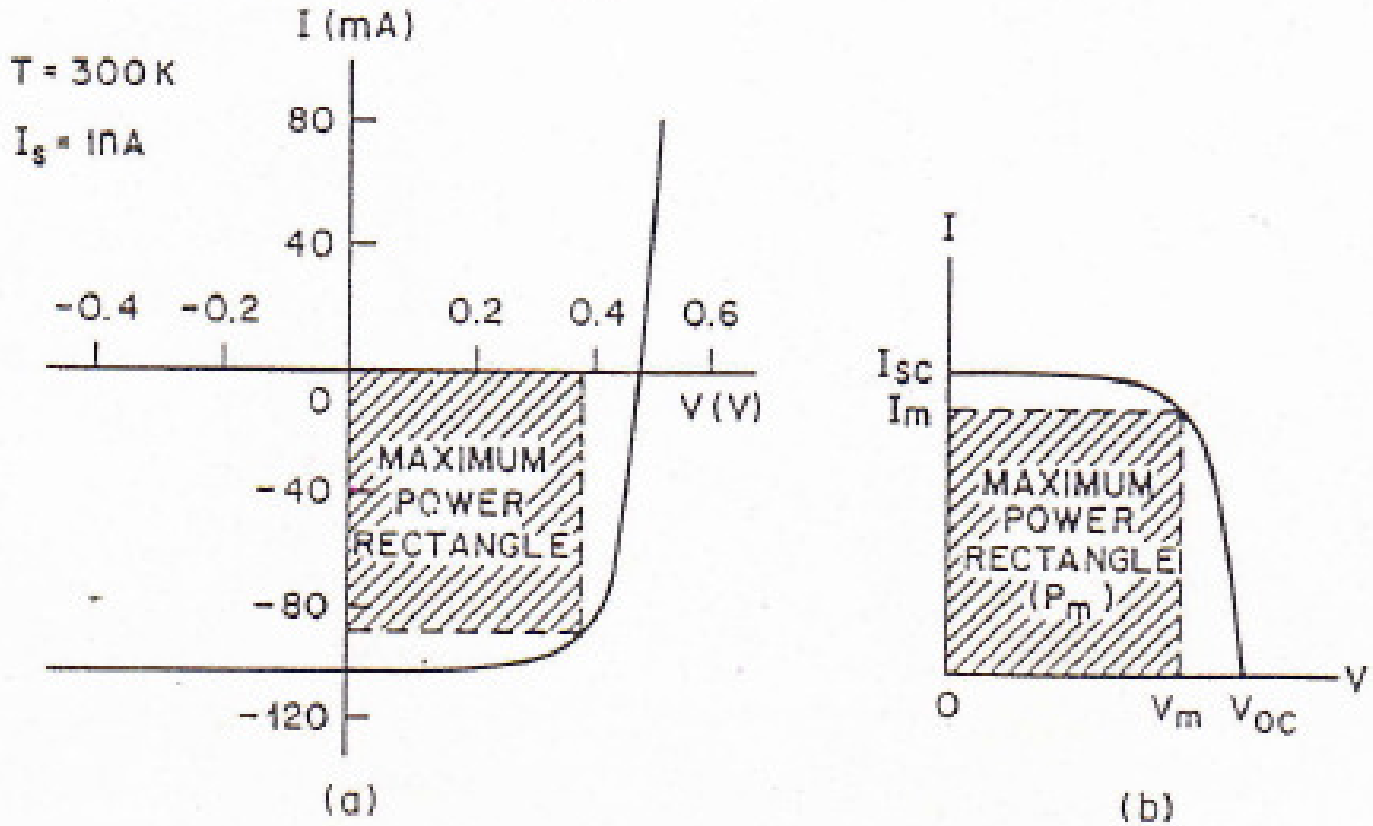


Fig. 41 (a) Current–voltage characteristics of a solar cell under illumination. (*b*) Inversion of (*a*) about the voltage axis.

Concentrazione
500x

Efficienza cella solare

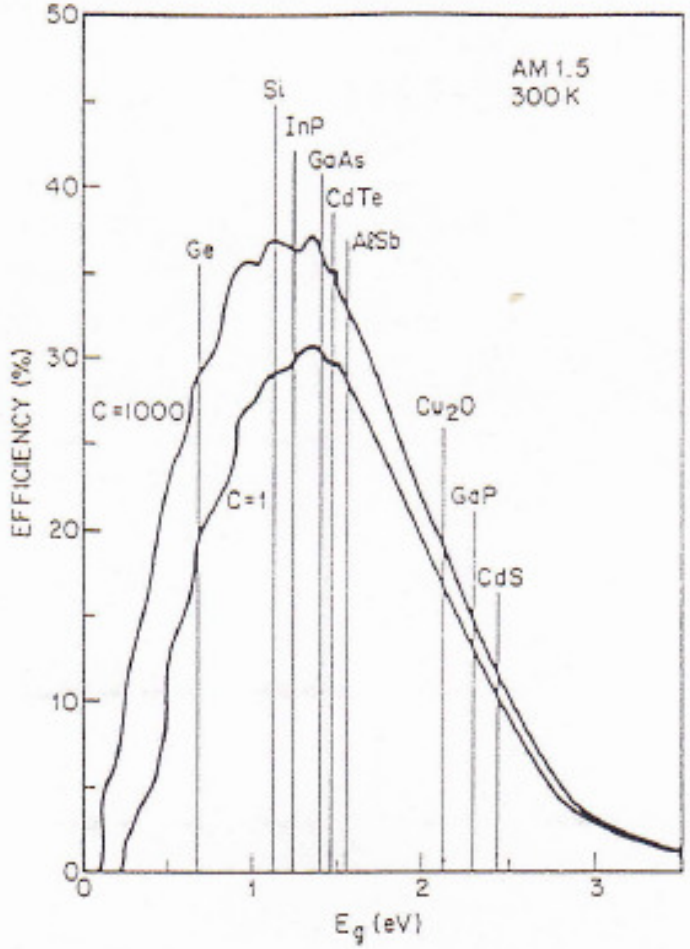
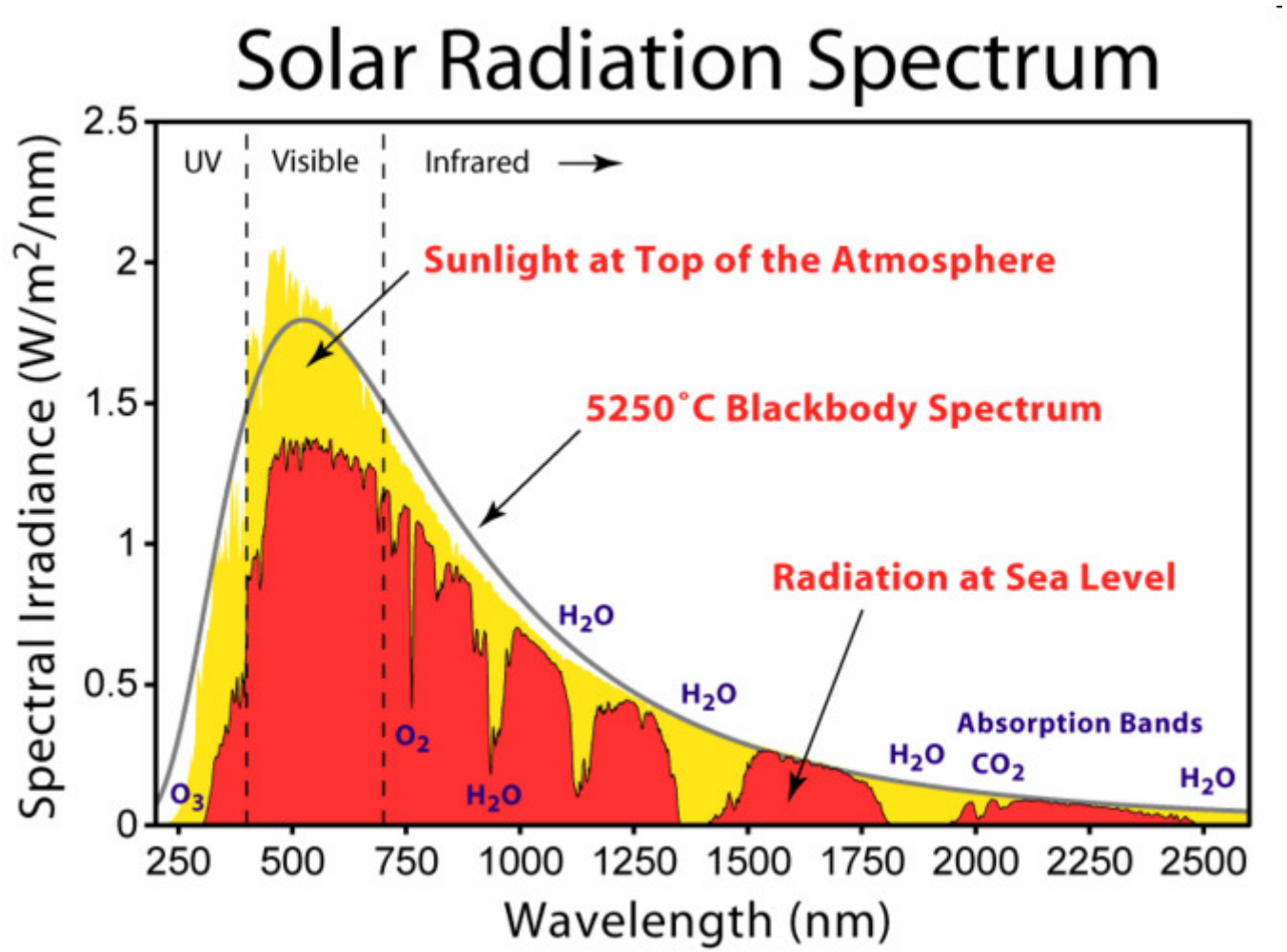
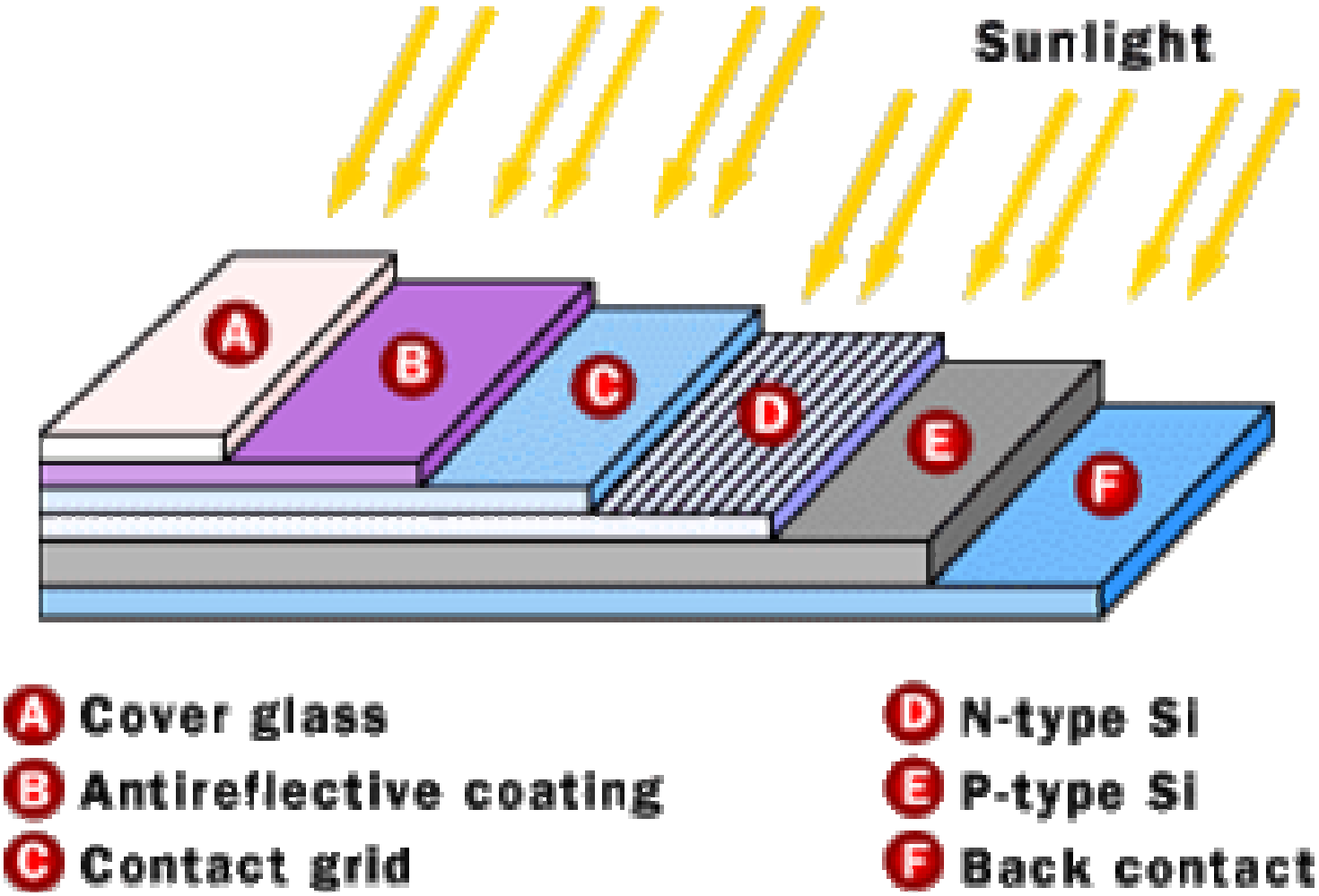


Fig. 7 Ideal solar-cell efficiency at 300 K for 1 sun and for 1000-sun concentration. (After Ref. 13.)

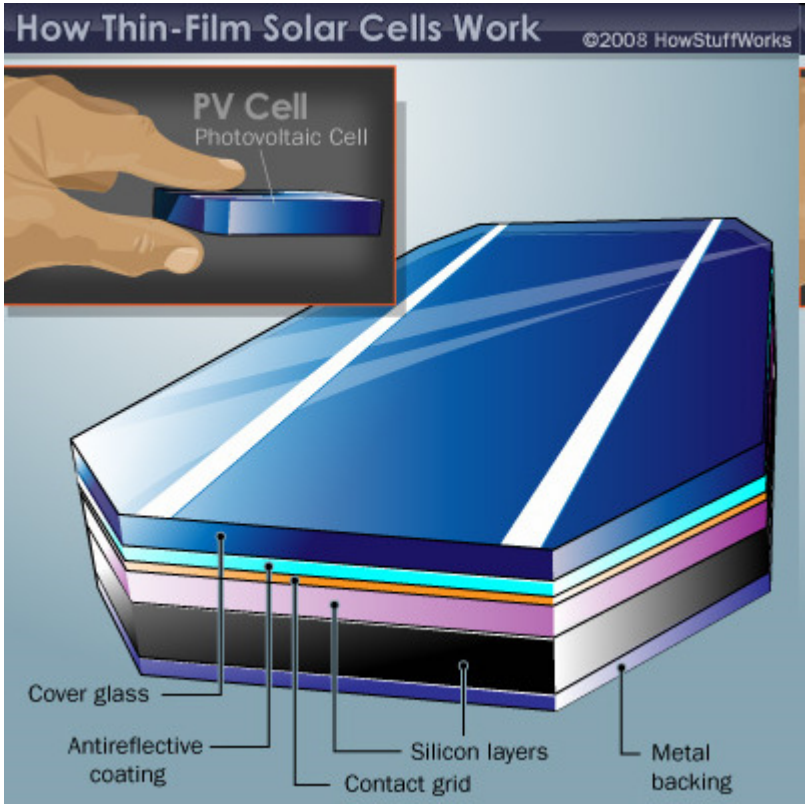
Quale materiale per celle solari?

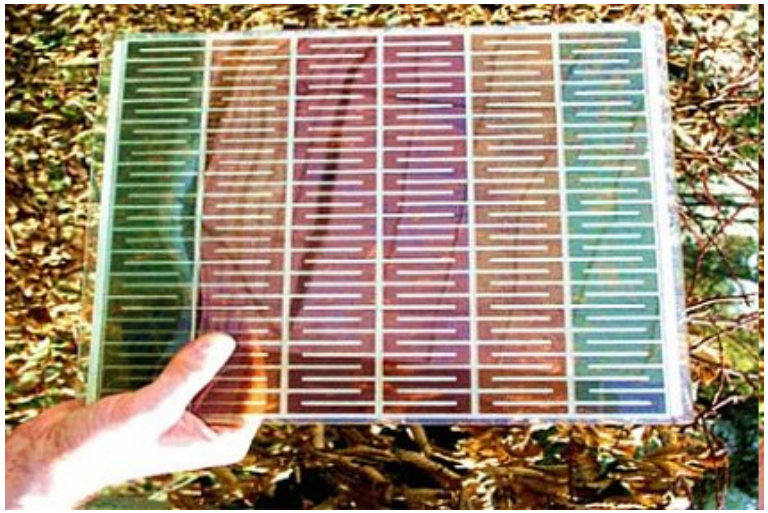


Struttura cella solare

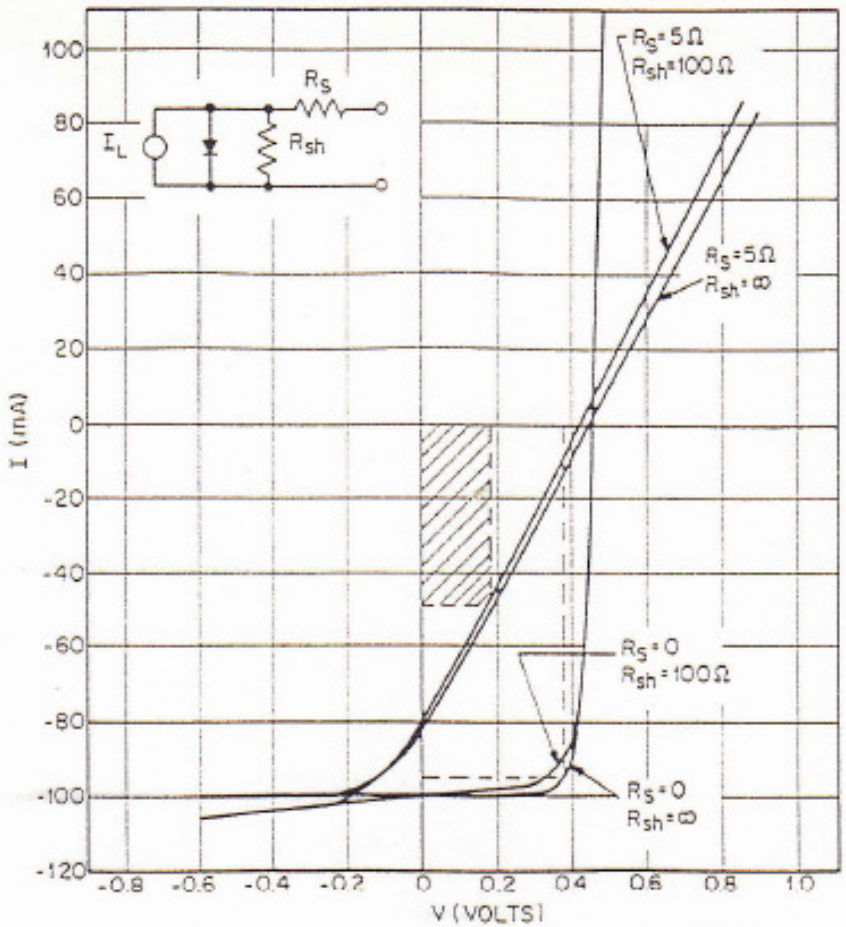


Struttura cella solare



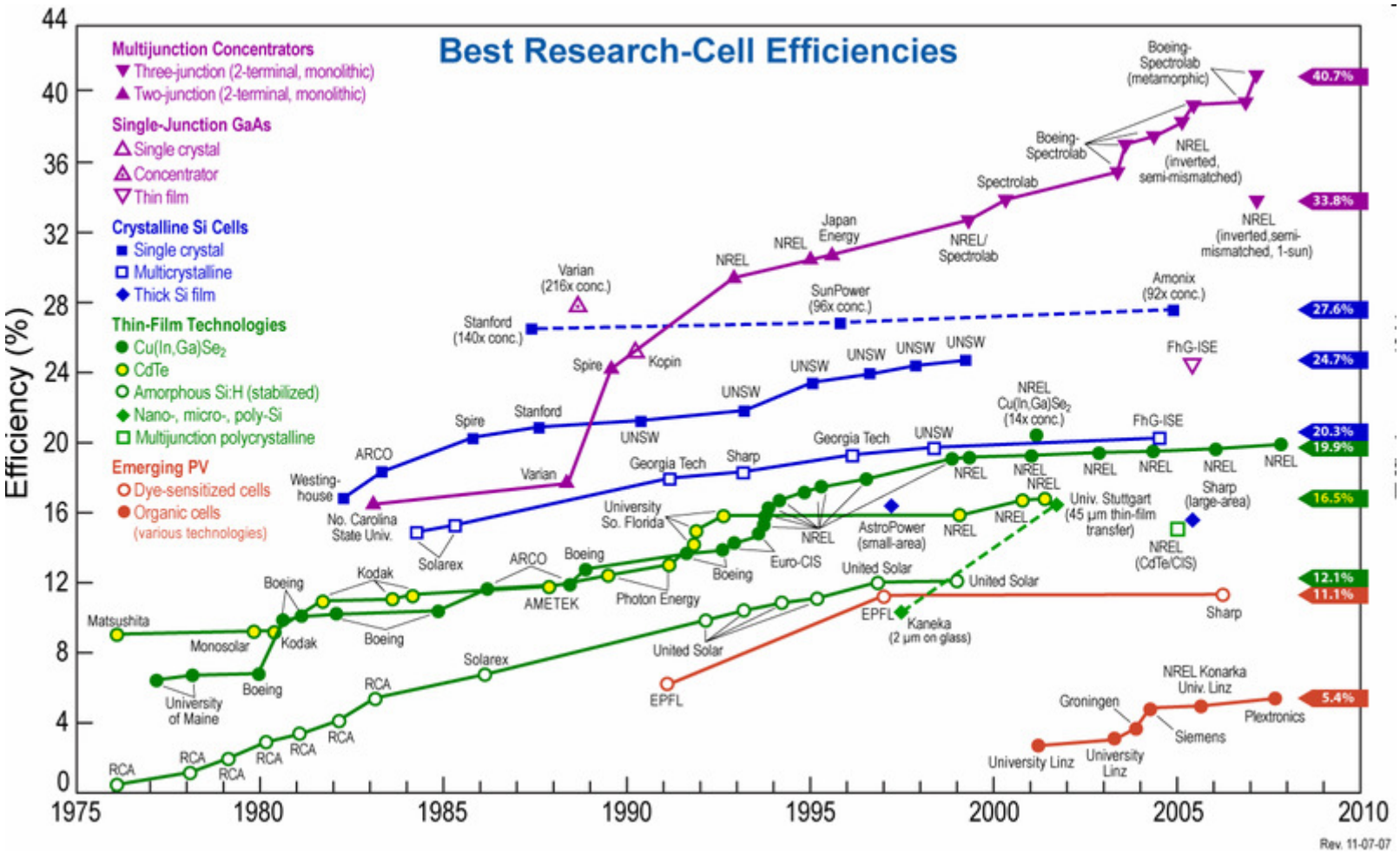


Shunt and series resistance



$$I = I_S\left(\exp\left(\frac{e(V - R_S I)}{KT}\right) - 1\right) - I_L$$

Fig. 12 Theoretical *I–V* characteristics for various solar cells that include series and shunt resistances. The insert shows the equivalent circuit. The parameters are identical to those shown in Fig. 5. (After Prince, Ref. 12.)


Best Research-Cell Efficiencies
Efficiency (%)
Multijunction Concentrators
Three-junction (2-terminal, monolithic)
Two-junction (2-terminal, monolithic)
Single-Junction GaAs
Single crystal
Concentrator
Thin film
Crystalline Si Cells
Single crystal
Multicrystalline
Thick Si film
Thin-Film Technologies
Cu(In,Ga)Se2
CdTe
Amorphous Si:H (stabilized)
Nano-, micro-, poly-Si
Multijunction polycrystalline
Emerging PV
Dye-sensitized cells
Organic cells
(various technologies)
40.7%
33.8%
27.6%
24.7%
20.3%
19.9%
16.5%
12.1%
11.1%
5.4%
Rev. 11-07-07