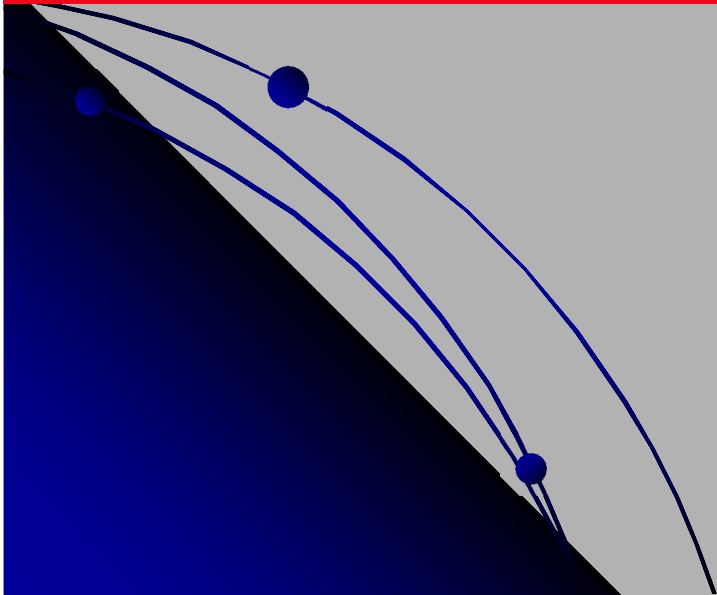
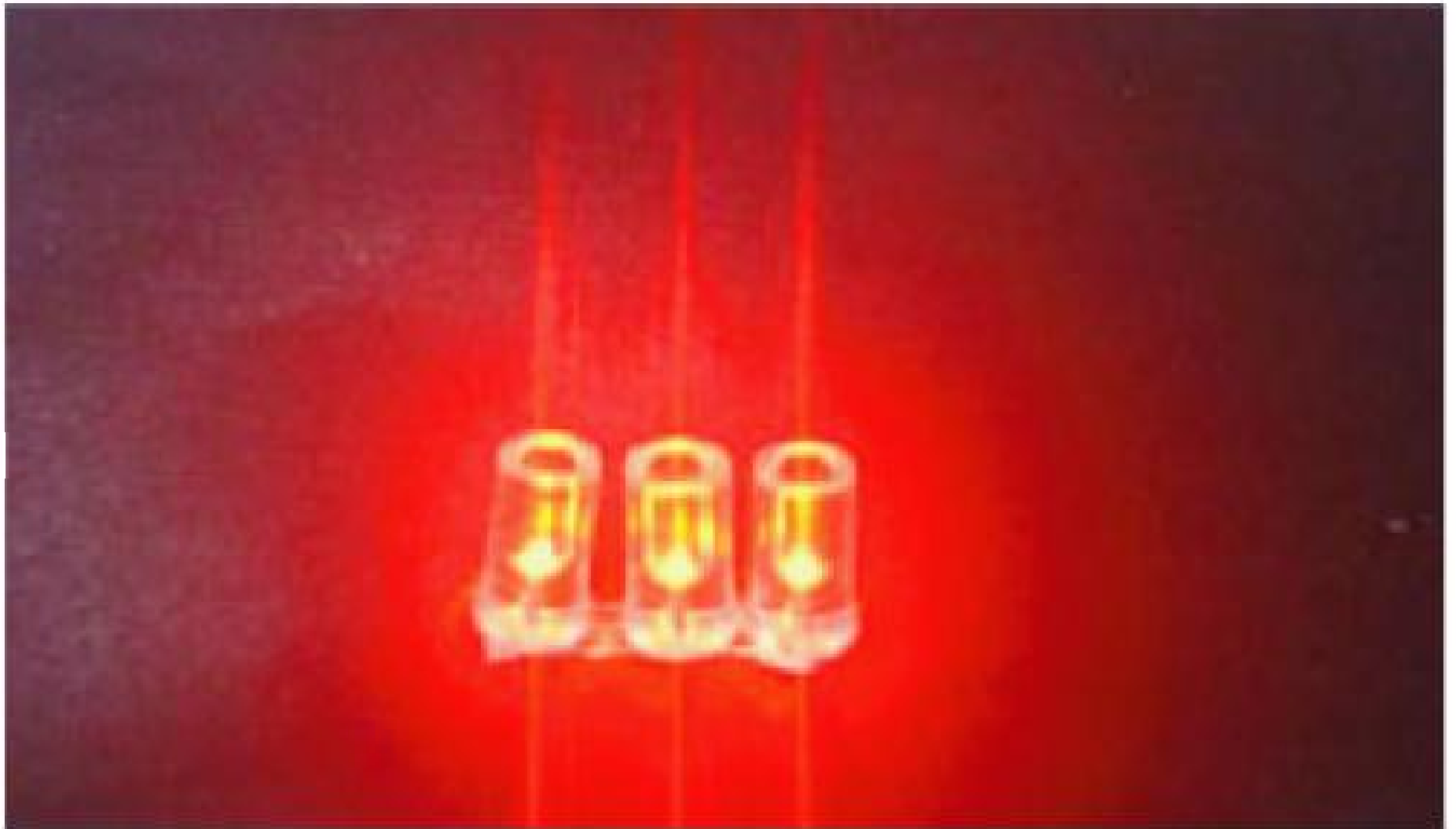


www.mientay.vn.com

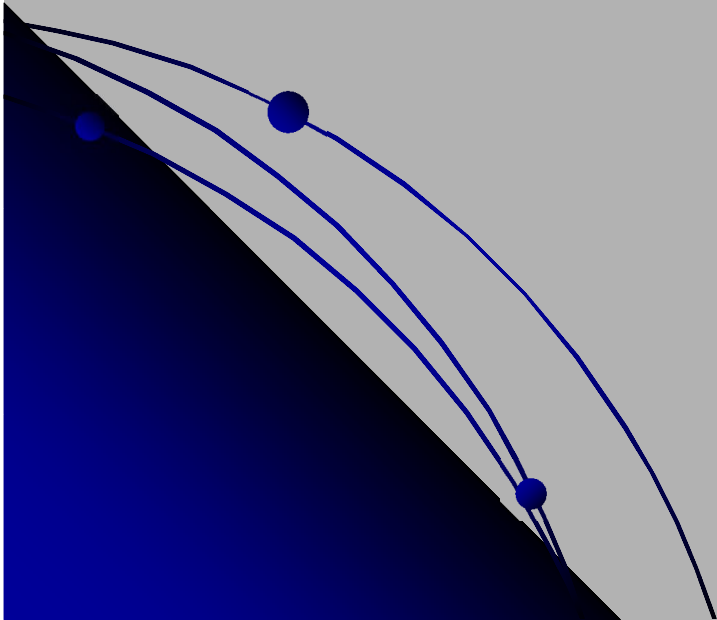


DIODE PHÁT QUANG (LED)

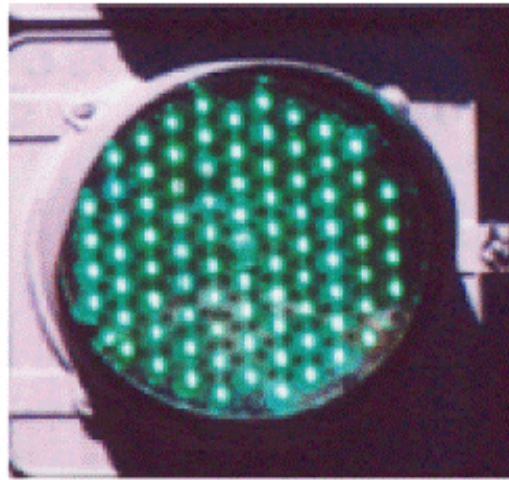
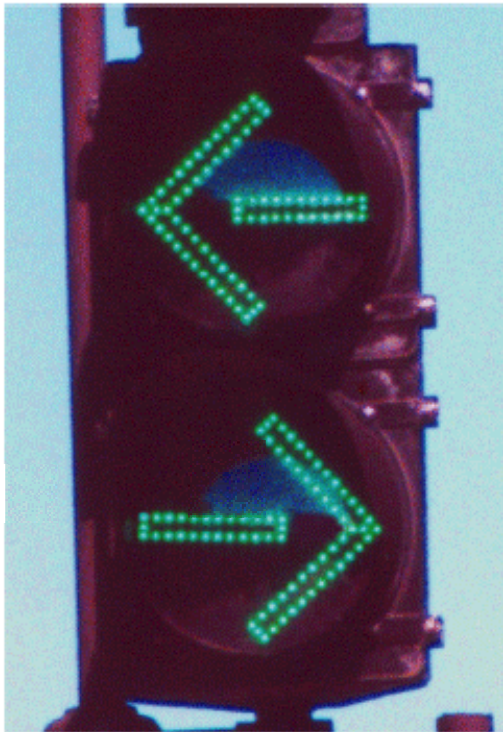


Nội dung trình bày

- Silicon tích cực p-n
- Cách phát photon của LED
- Vật liệu dùng làm LED
- Một số loại LED

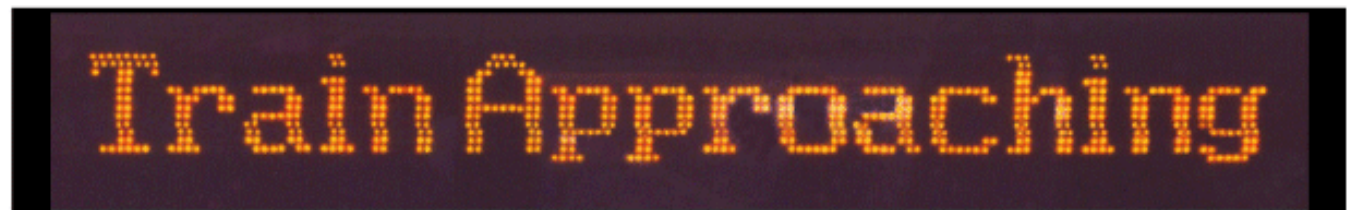
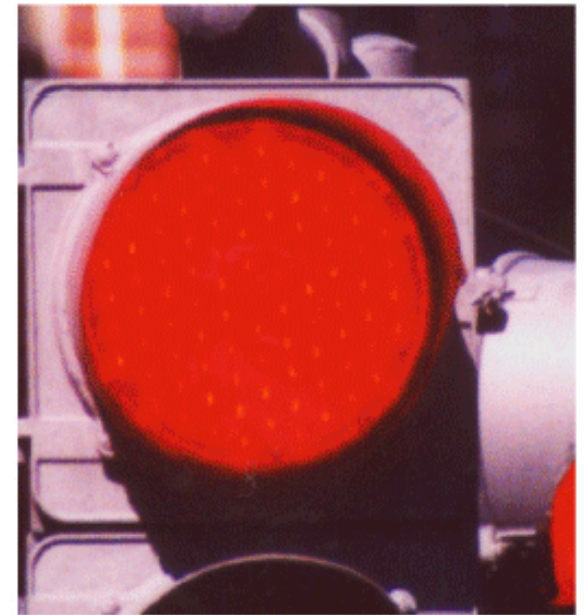


LED dùng làm tín hiệu đèn giao thông



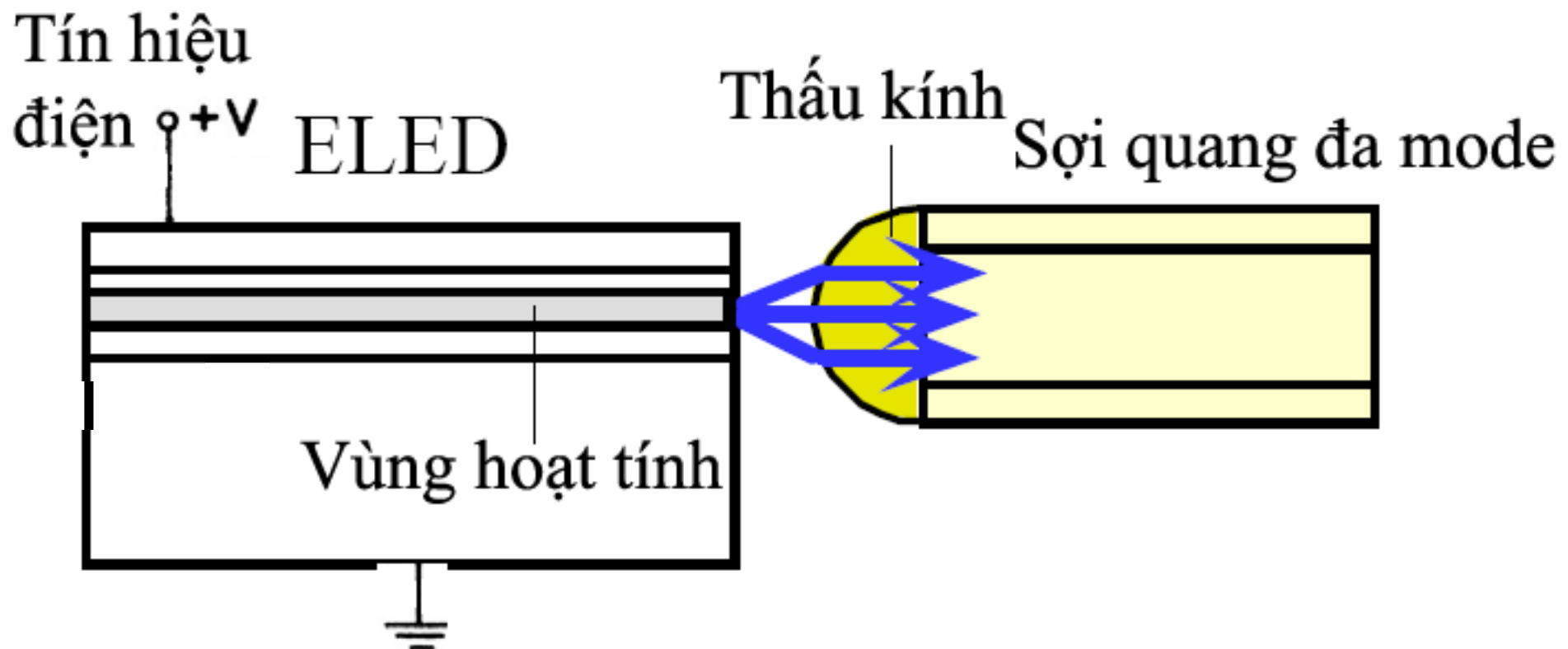
LED xanh bằng được chế tạo bằng các lớp tiếp xúc GaInN/GaN

ứng dụng hiện thực mã 7 số
trong internet



LED AlGaInP/GaAs màu đỏ và hồng phách 2006 LED book pictures

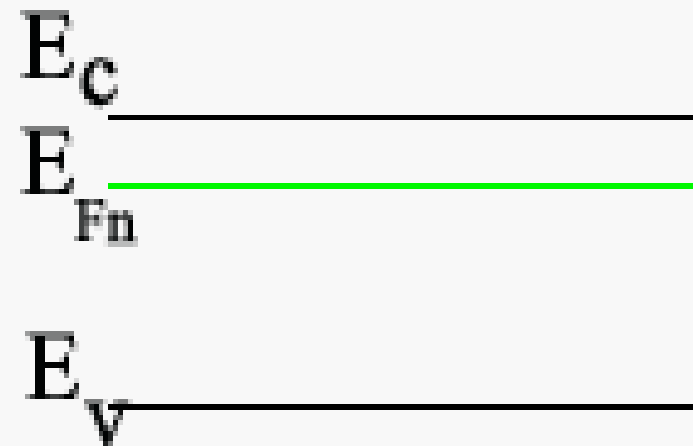
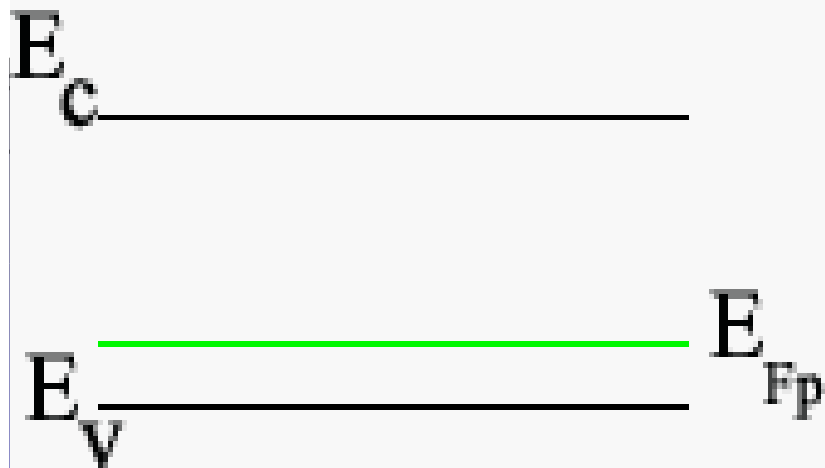
Trong truyền thông quang học

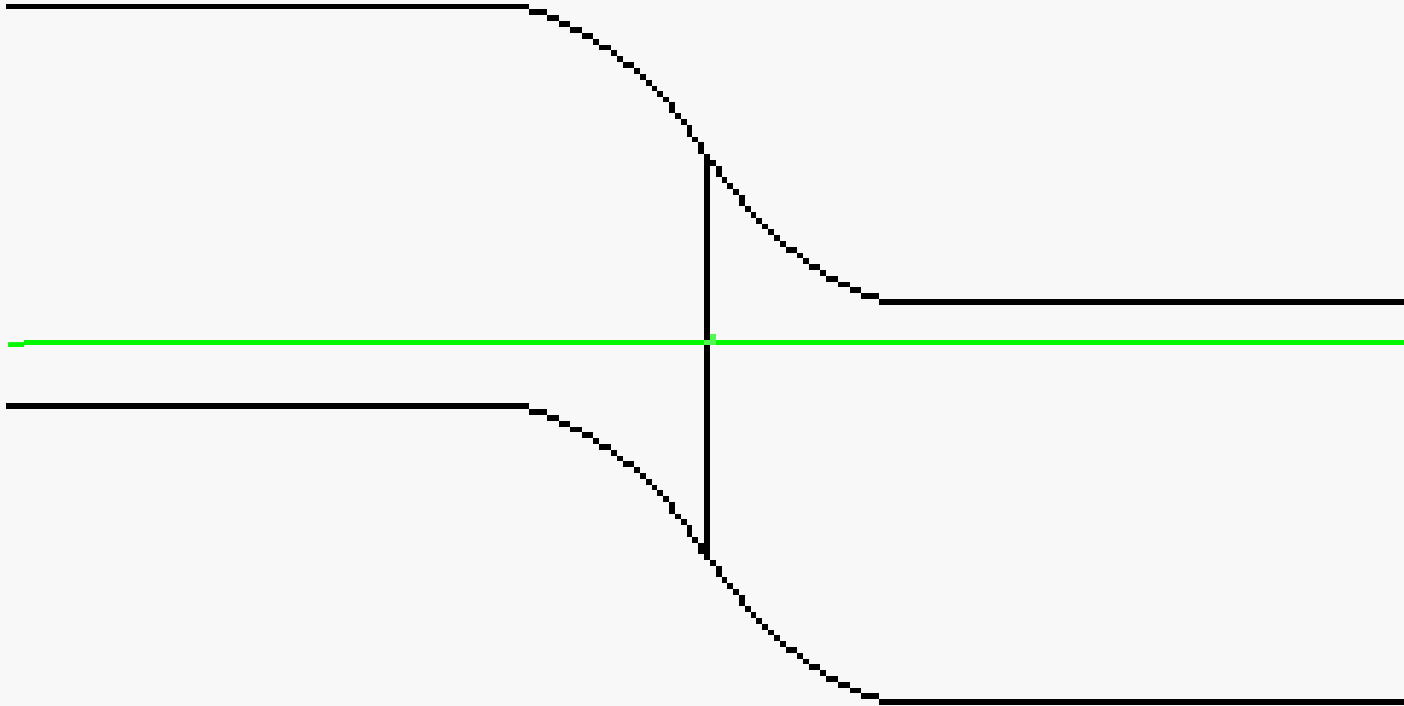
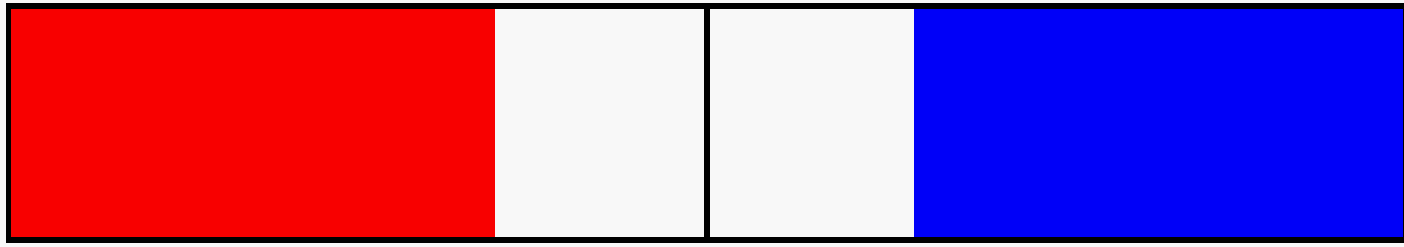


Silicium p-n

Lóp p

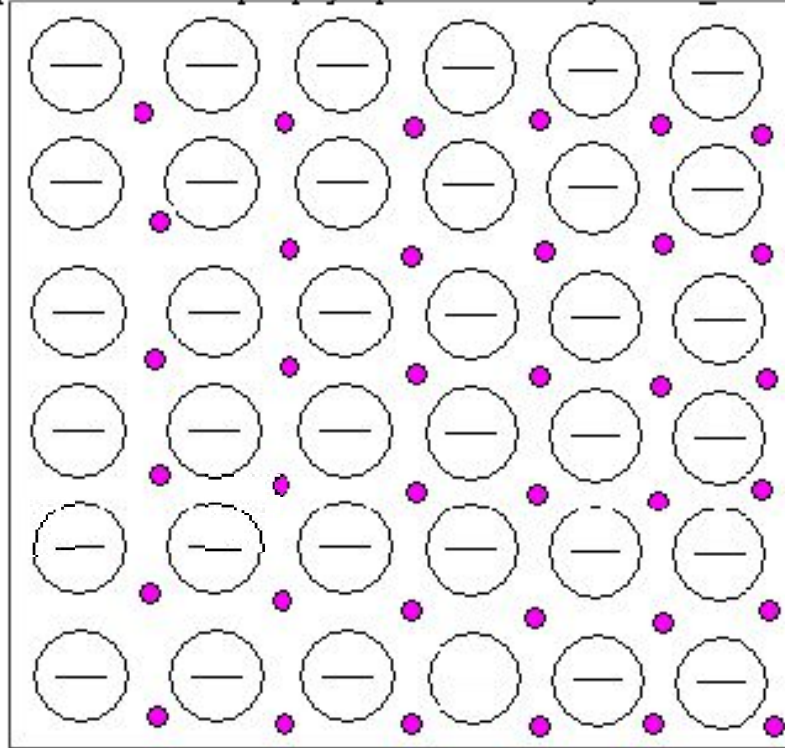
Lóp n



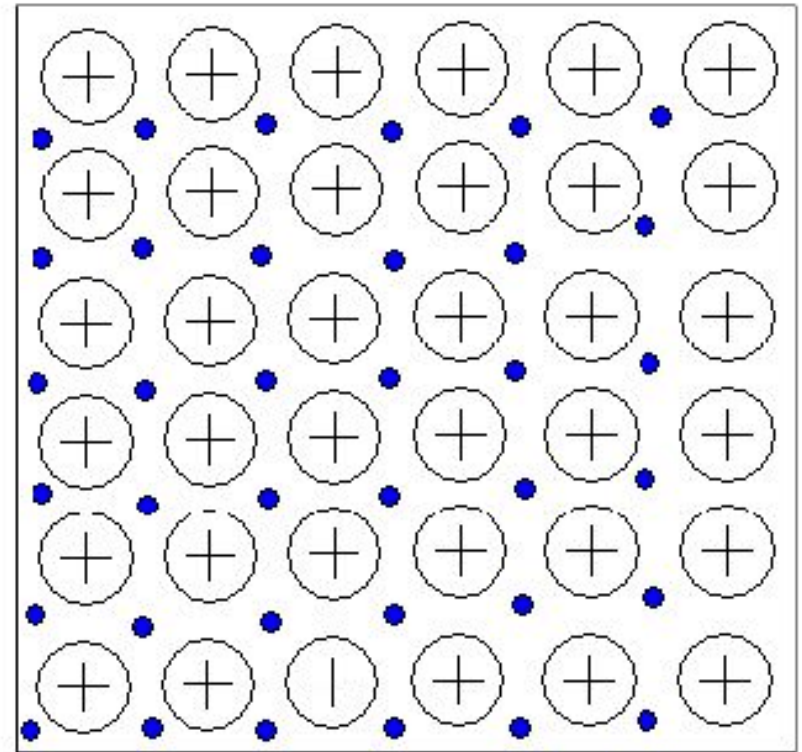


Các loại hạt tải điện trong bán dẫn loại P và N

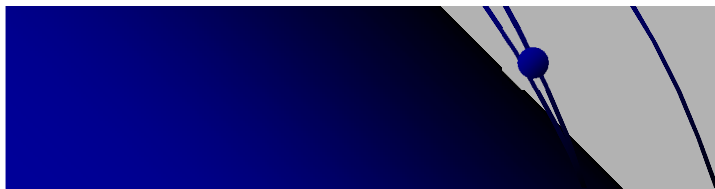
http://www.etudes.ecp.fr/physique/illustrations/jonction_PN.htm#debut

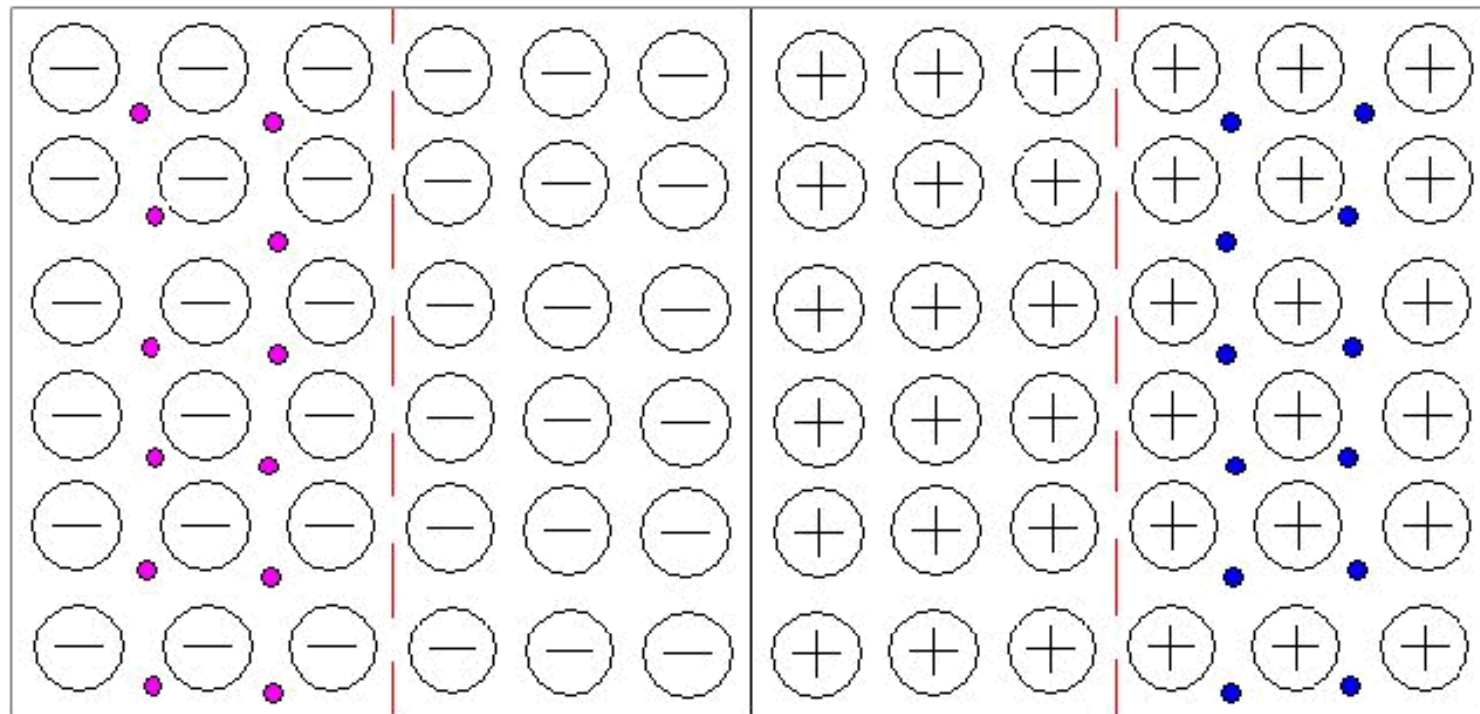


P



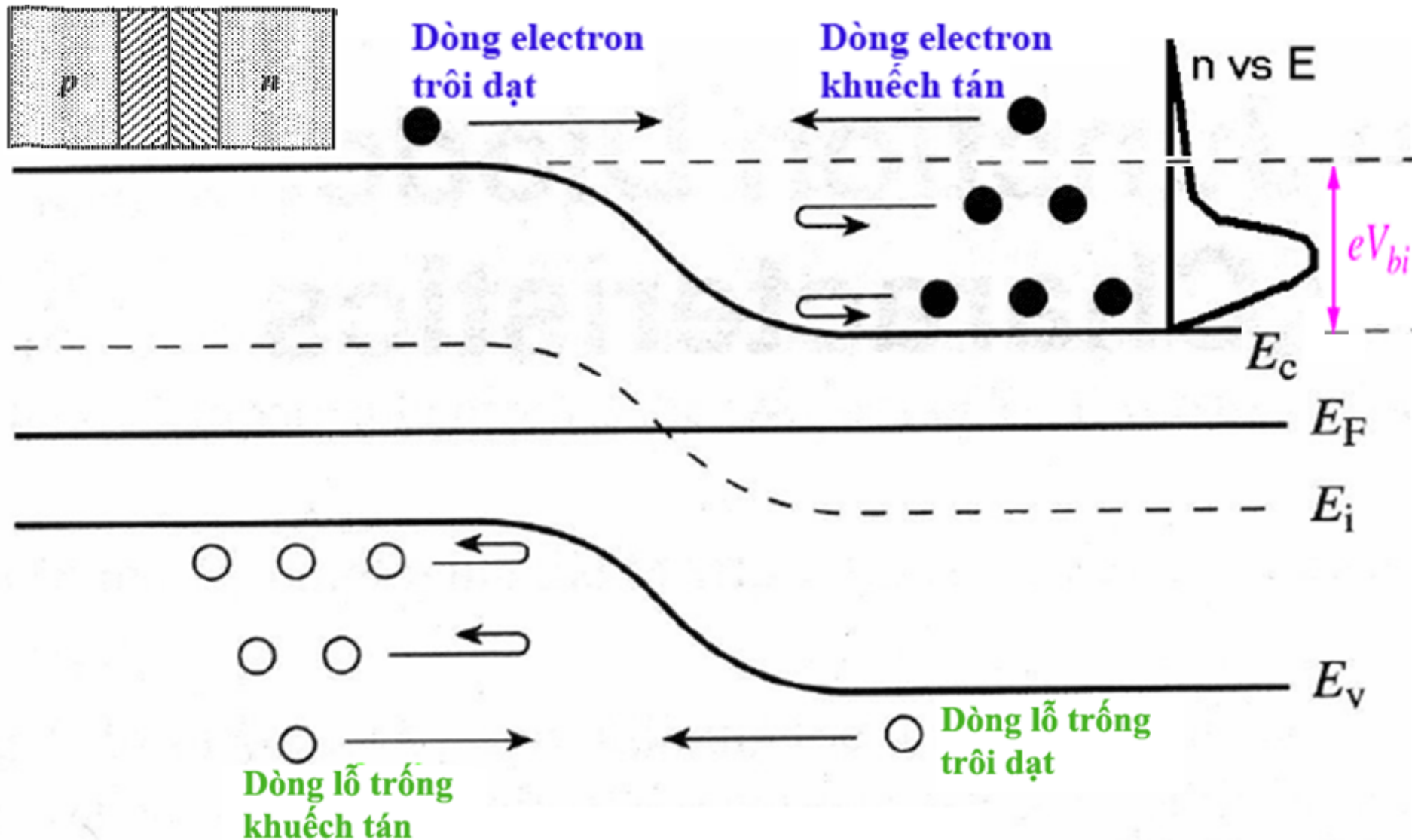
N



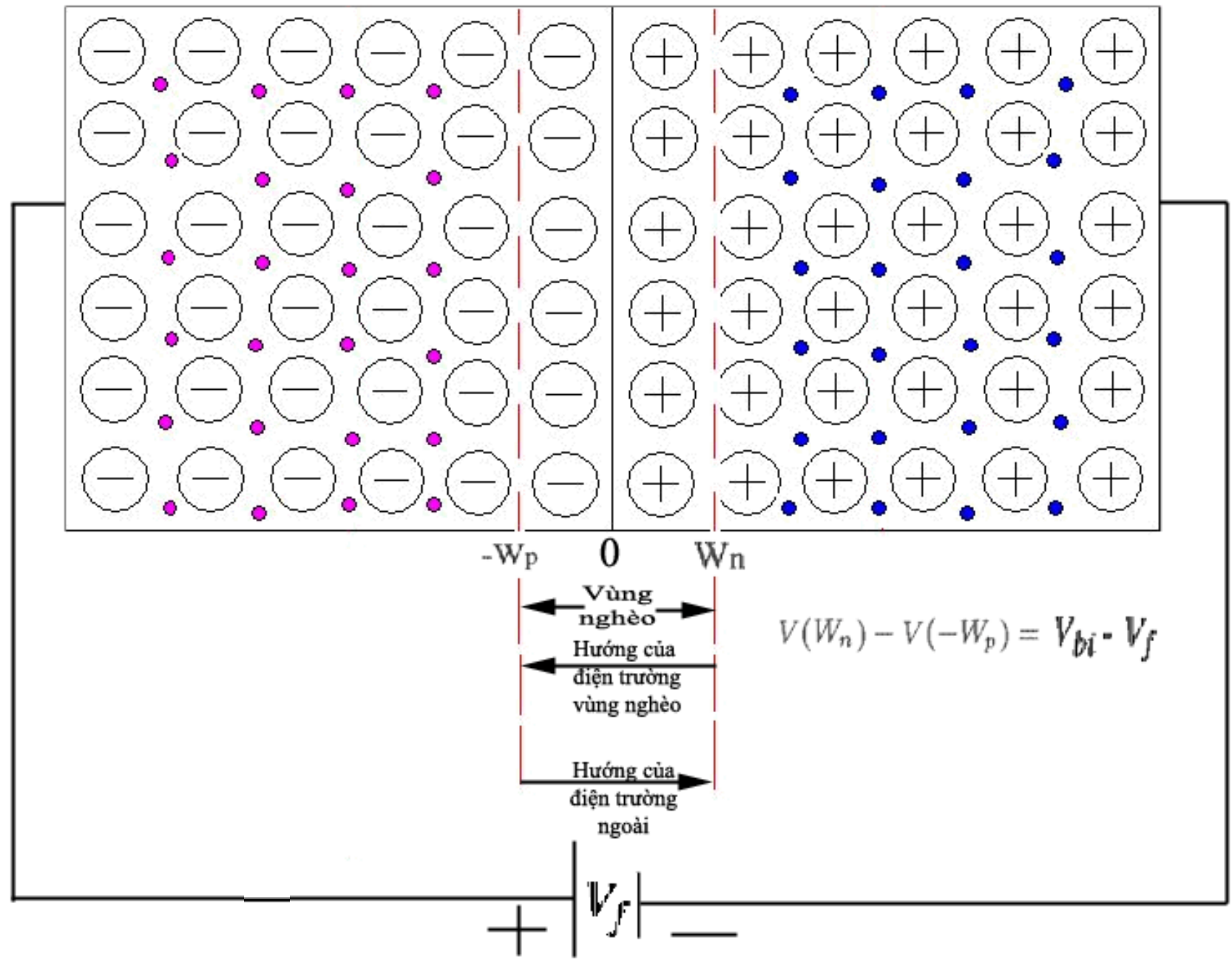


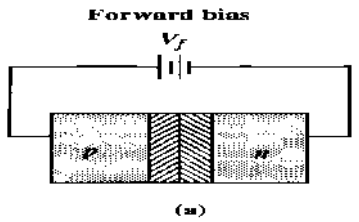
$-W_p$ 0 W_n
← **Vùng nghèo** →
Hướng của
điện trường
do vùng nghèo
tạo nên

$$V(W_n) - V(-W_p) = V_{bi}$$



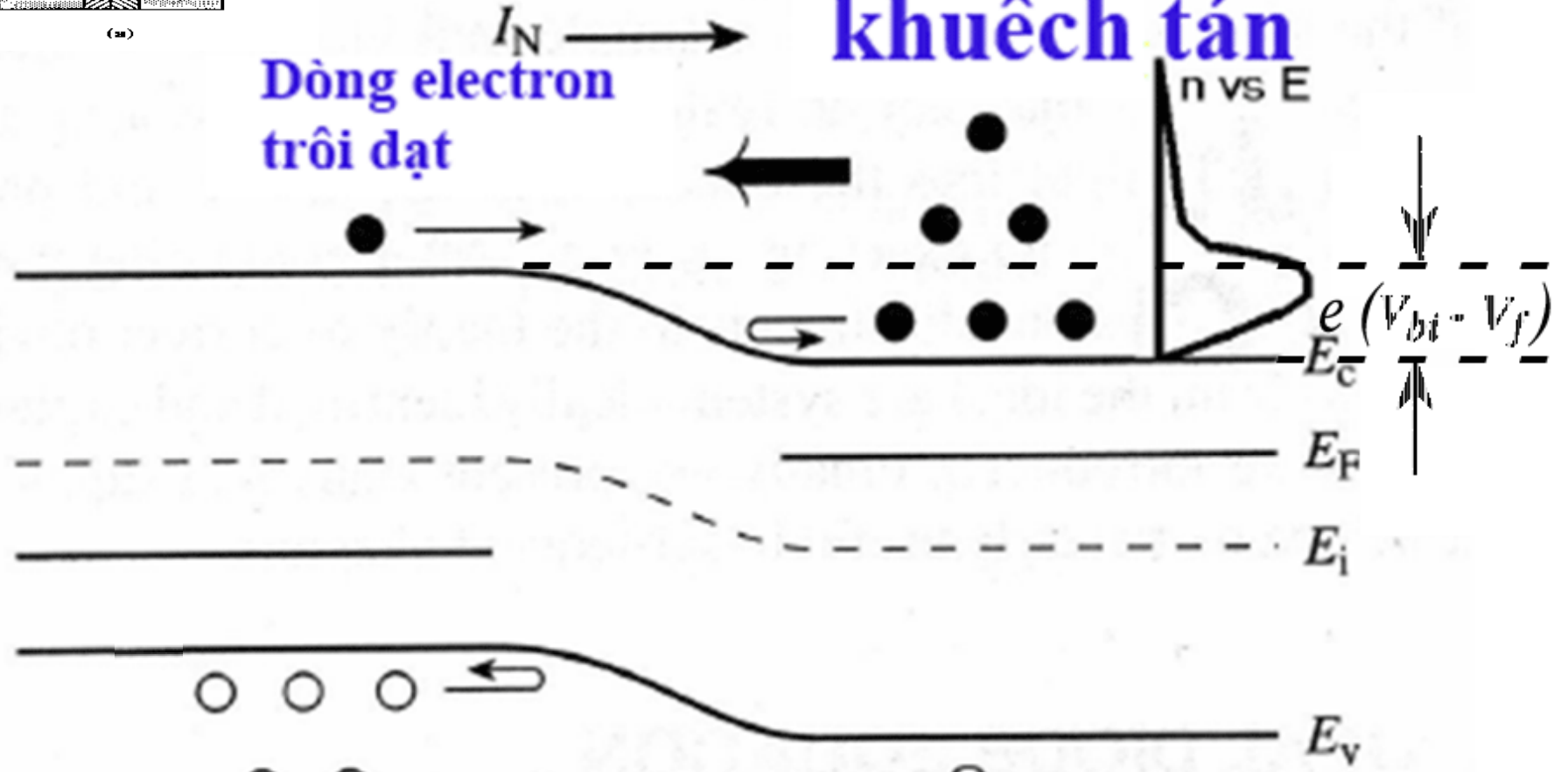
Tiếp xúc p-n ở trạng thái cân bằng





Dòng electron khuếch tán

Dòng electron trôi dạt



Dòng lỗ trống khuếch tán

Dòng lỗ trống trôi dạt

Phân cực thuận

I_N

I_P

$e(V_{bi} - V_f)$

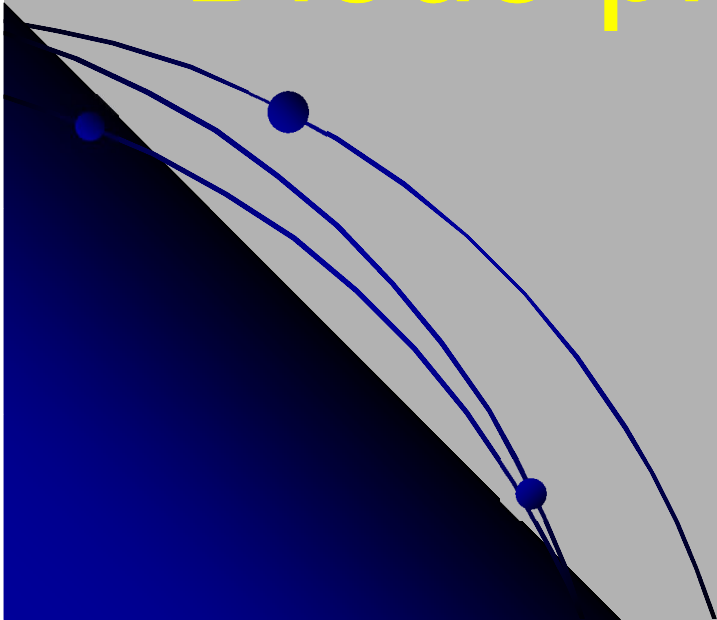
E_c

E_f

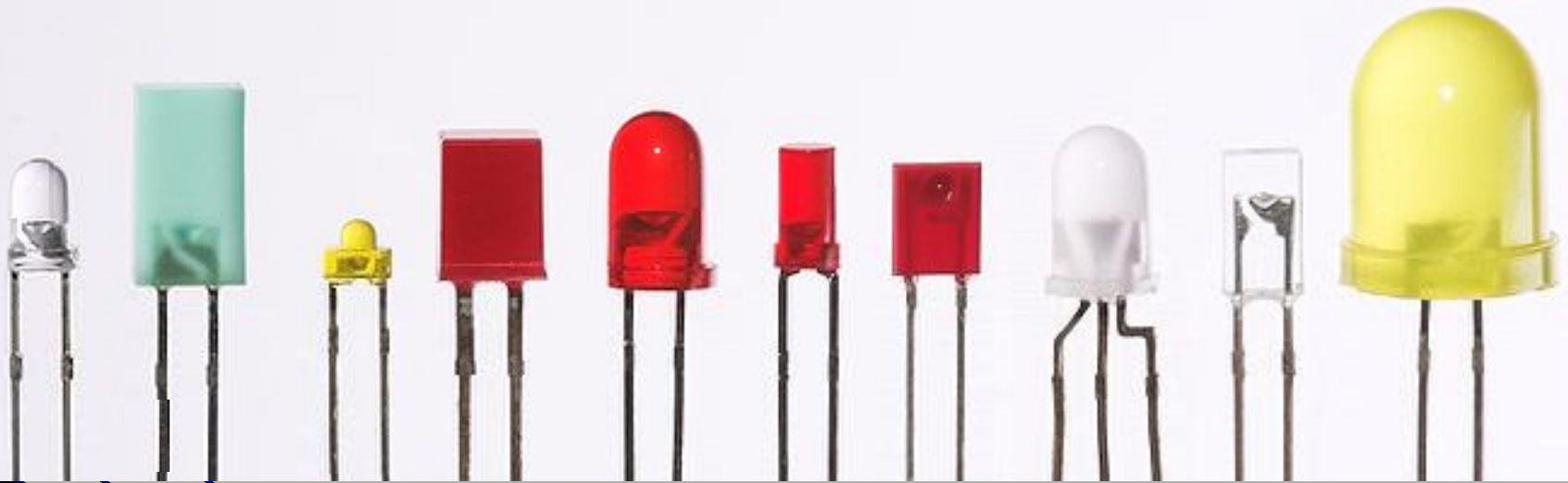
E_i

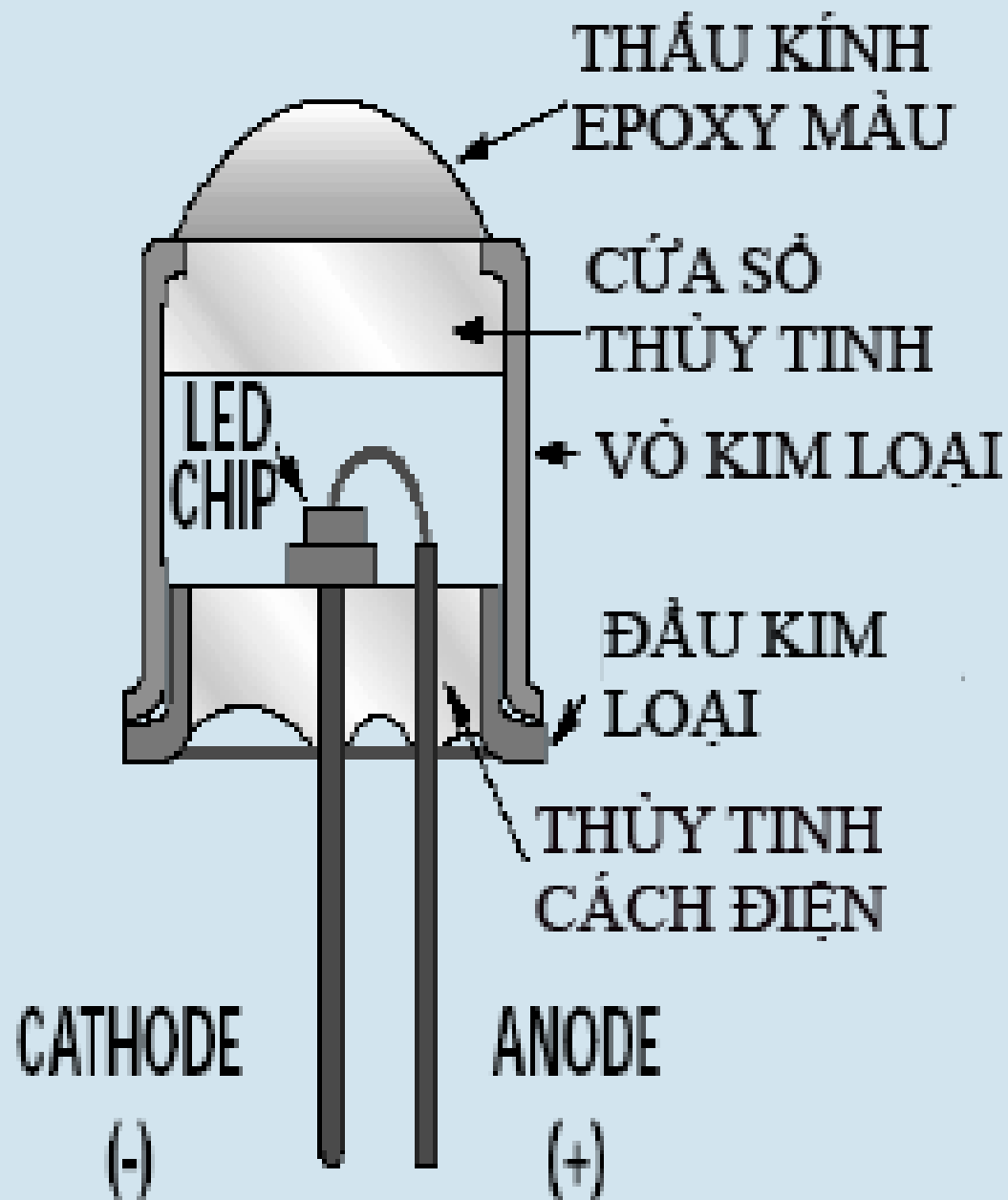
E_v

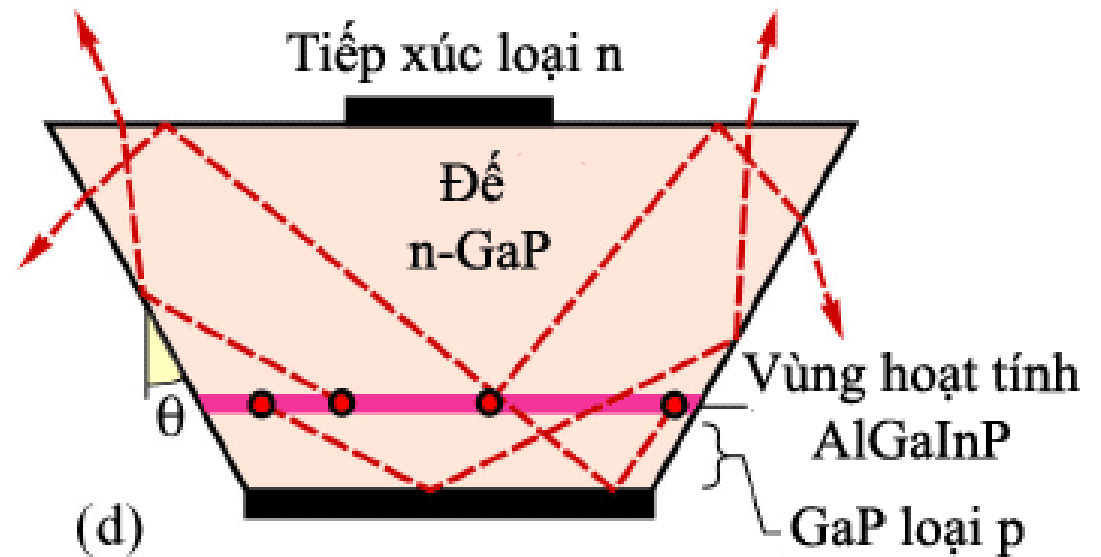
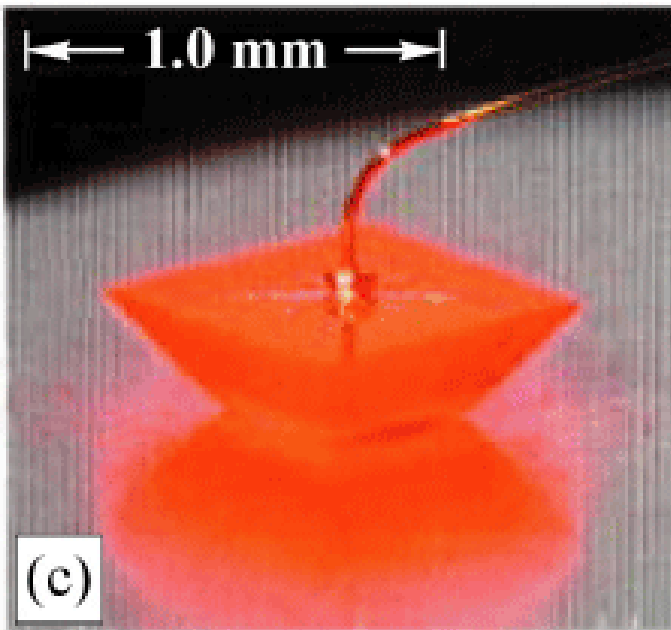
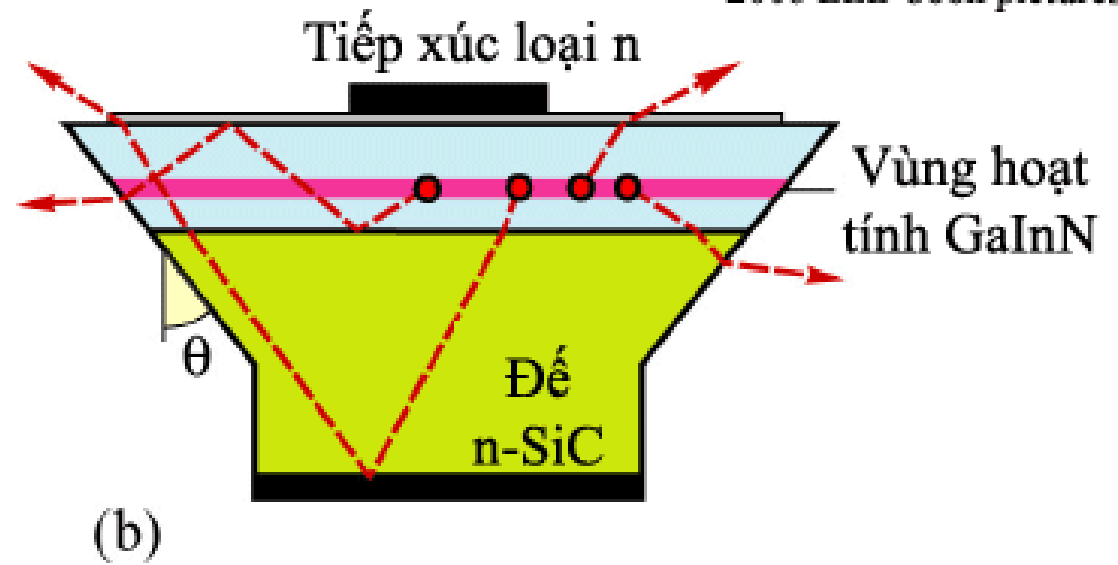
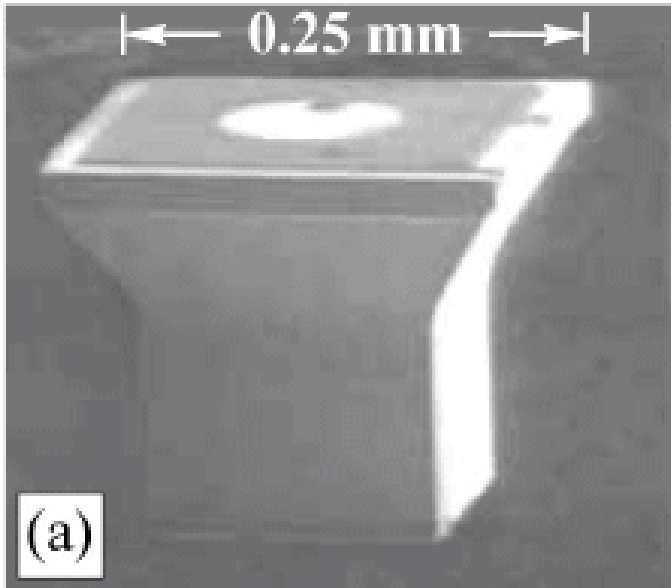
Diode phát quang (LED)



Hình nh m t s lo i LED



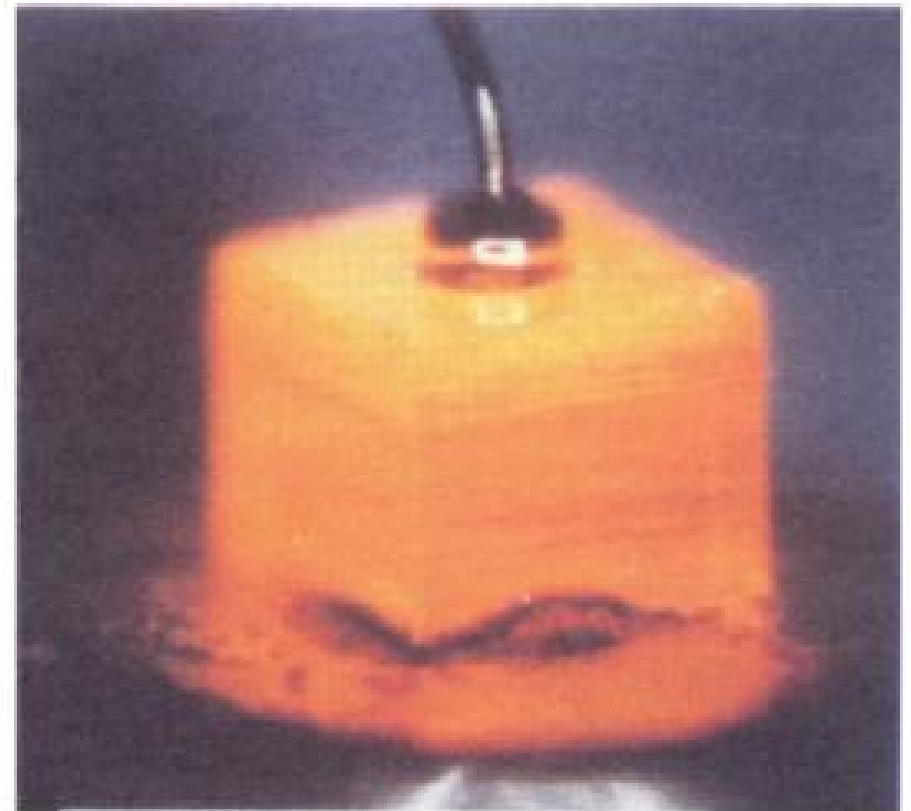




(a) AS LED

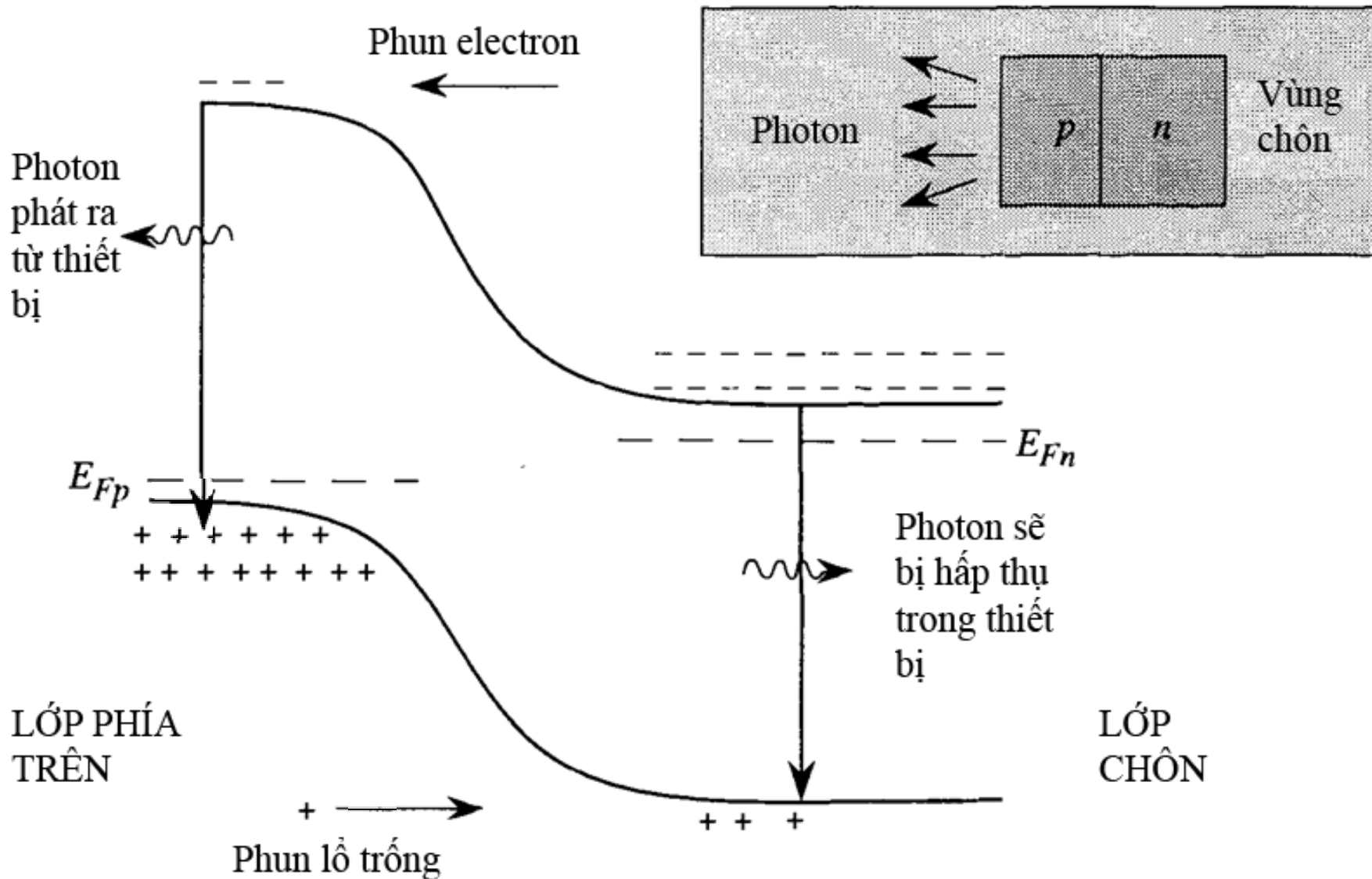


(b) TS LED

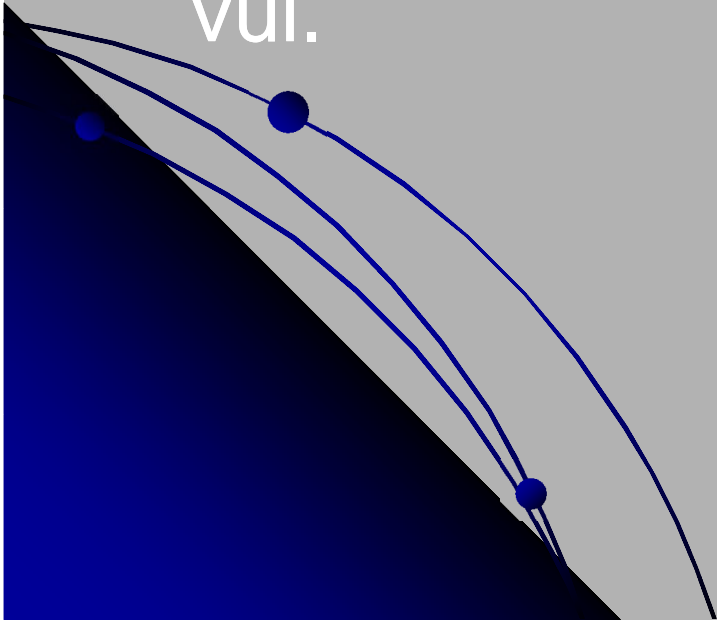


Cách phát photon của LED?

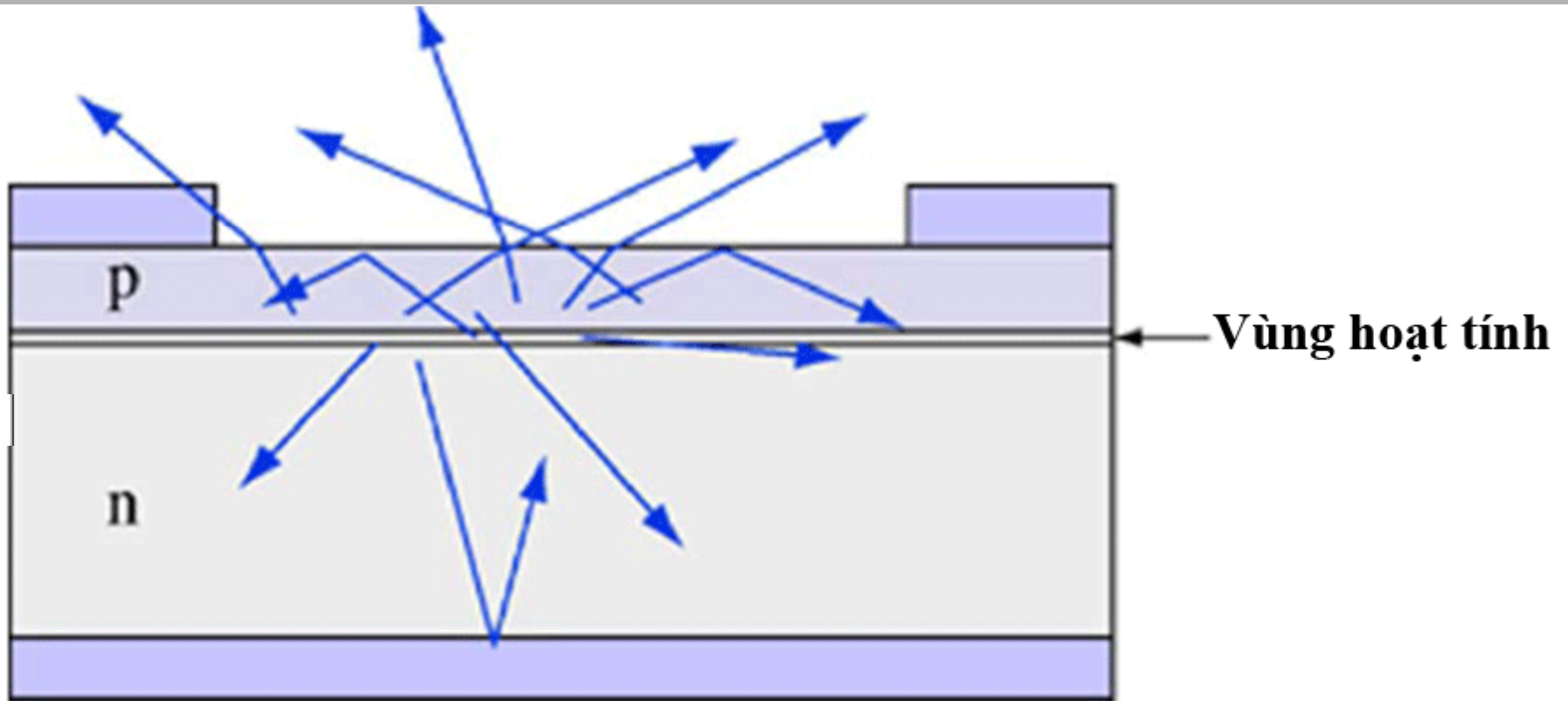
Cách là “phun i n phát quang”.



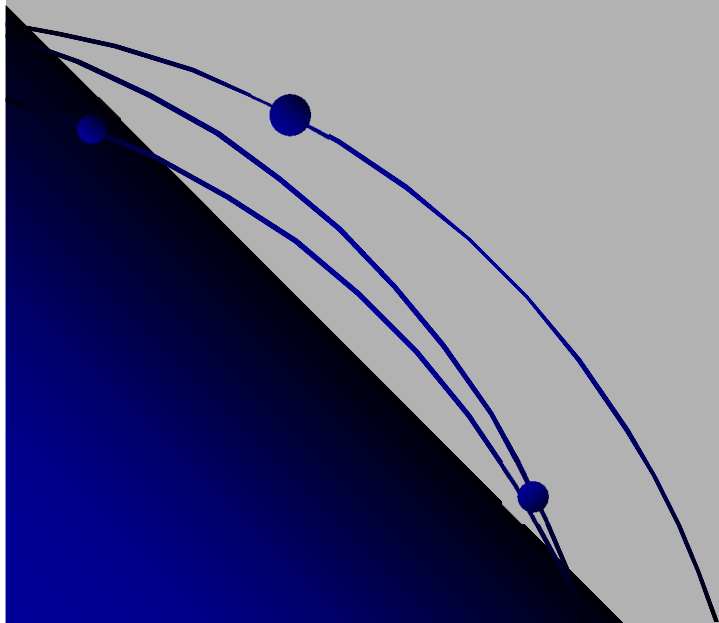
- Photon được phát ra sâu trong thị t b có xác suất b h p th l i cao.
- Ph i thi t k sao cho photon được phát ra gần l p trên ch không ph i l p chôn vùi.



- Thường thì lớp p trên của LED loại p-n phát ra photon. Trong lớp này thì phải có nhiều electron như nhiều lỗ trống.



Vấn đề dùng chất LED



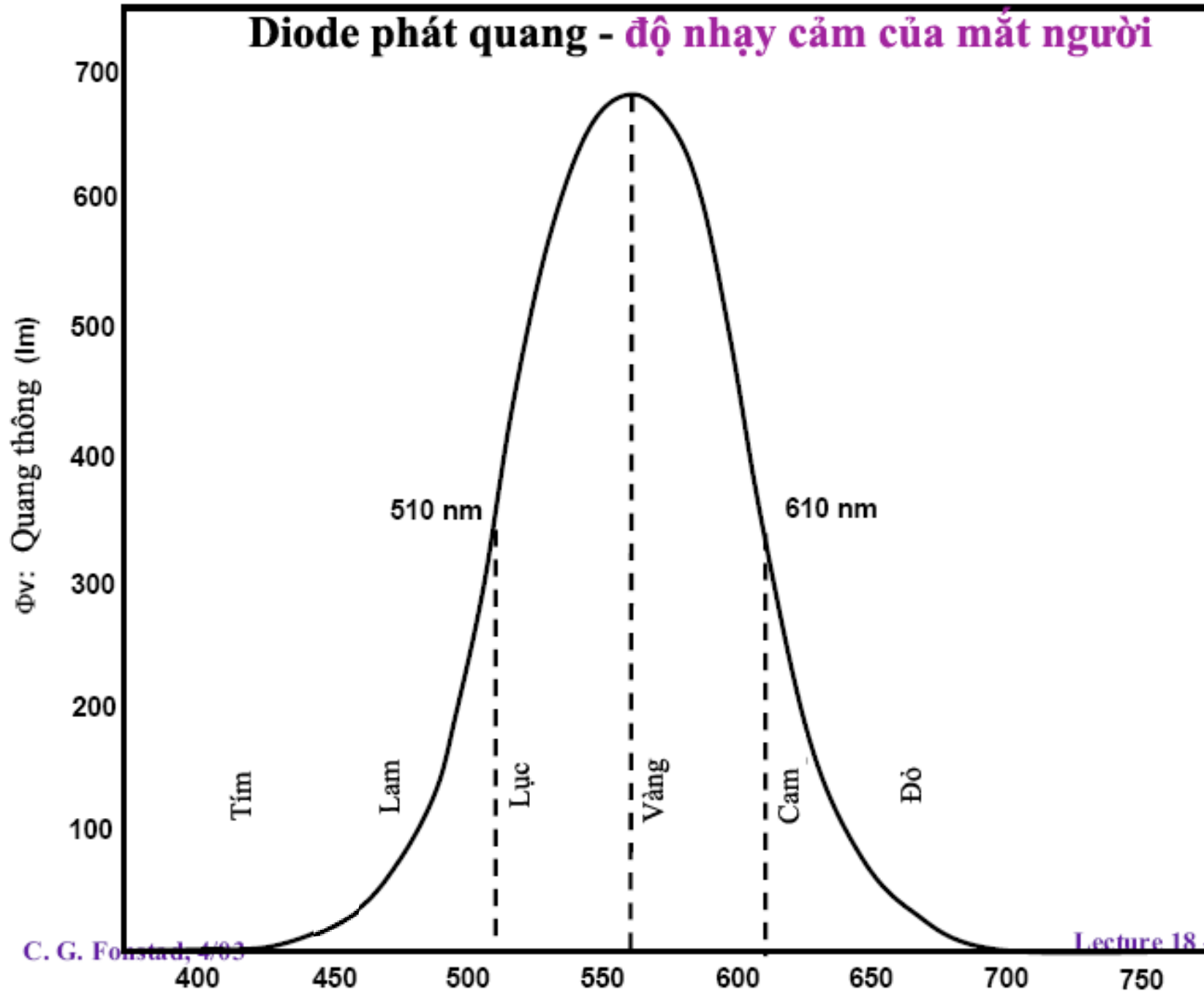
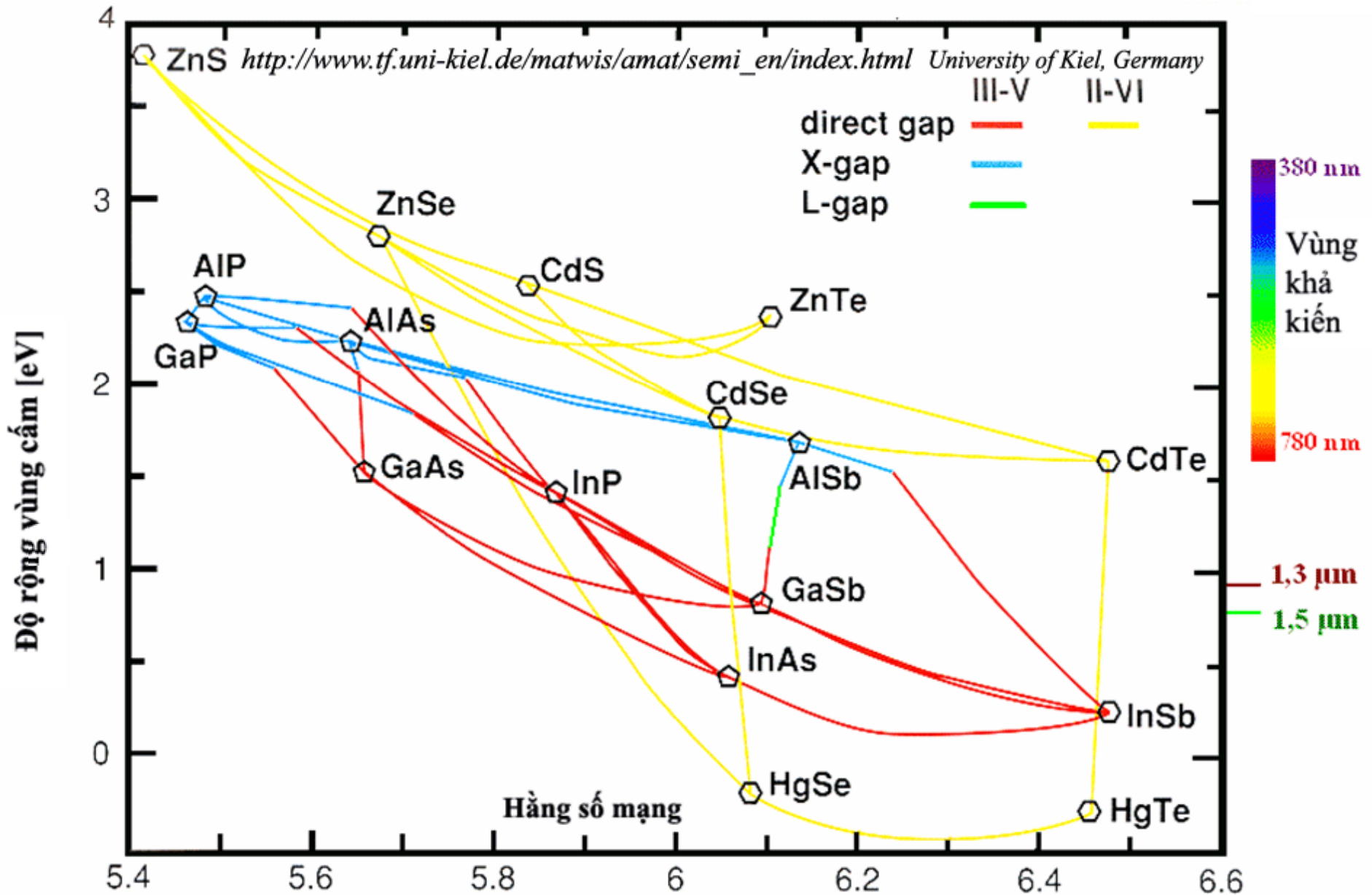
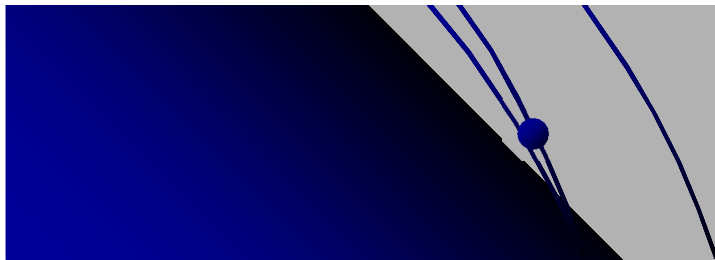
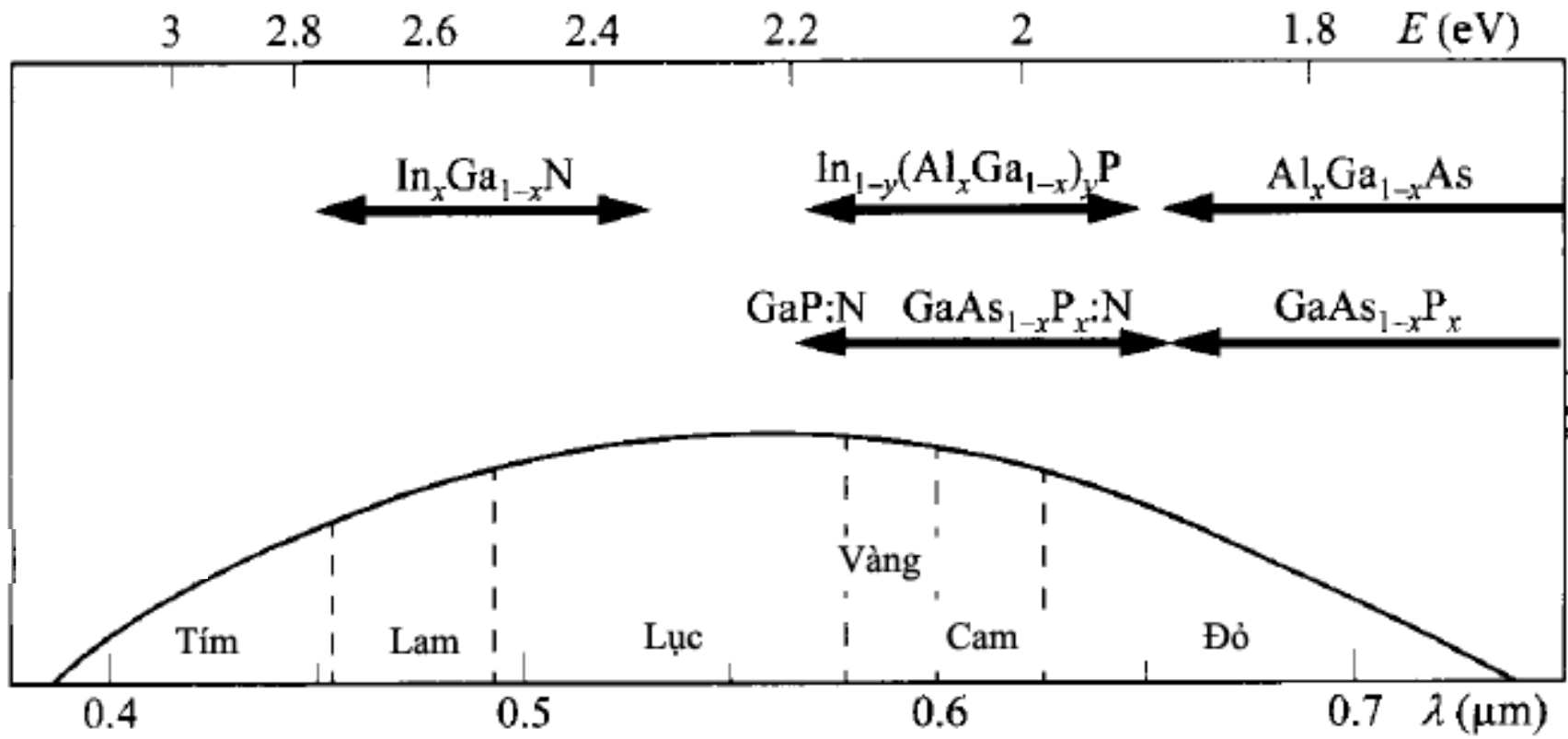


Table 5.1 CHARACTERISTICS OF VISIBLE LIGHT-EMITTING DIODES (from M. G. Craford, "LEDs Challenge the Incandescents," *IEEE Circuits and Devices Magazine*, September 1992).

Cấu trúc	Vật liệu	Loại vùng cấm	Bước sóng, nm (màu)	Hiệu suất điện hình lm/W
Đồng tiếp xúc	GaAsP	Direct	650 (red)	0.15
	GaP: Zn, O	Indirect	700 (red)	0.4
	GaAsP: N	Indirect	630 (red), 585 (yellow)	1
	GaP: N	Indirect	565 (yellow-green)	2.6
	GaP	Indirect	555 (green)	0.6
	SiC	Indirect	480 (blue)	0.04
	Dị tiếp xúc đơn	AlGaAs	Direct	650 (red)
Dị tiếp xúc kép	AlGaAs	Direct	650 (red)	4
	AlGaP	Direct	620 (orange)	20
	AlInGaP	Direct	595 (amber)	20
	AlInGaP	Direct	570 (yellow-green)	6
	GaN	Direct	450 (blue)	0.6
Dị tiếp xúc kép với đế trong suốt	AlGaAs	Direct	650 (red)	8

trình vùng cấm và hình sắc trình



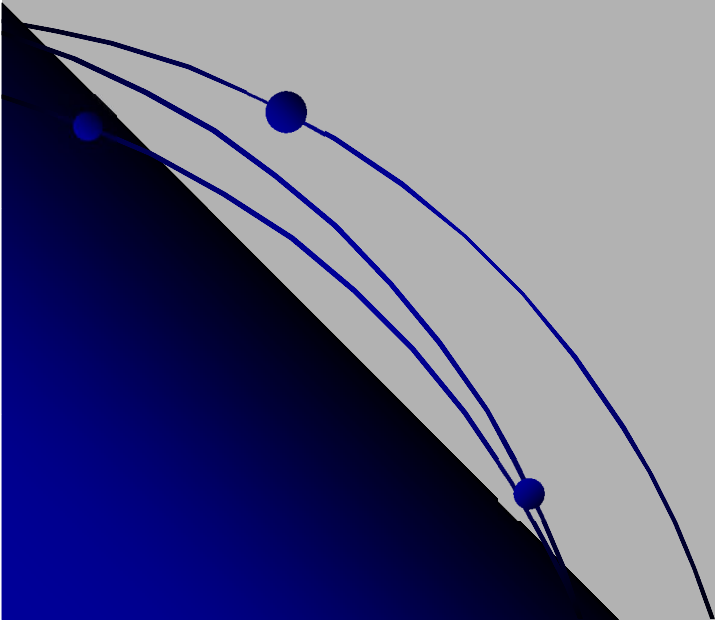


Compound	Direct Energy Gap E_g (eV)
$\text{Al}_x\text{In}_{1-x}\text{P}$	$1.351 + 2.23x$
$\text{Al}_x\text{Ga}_{1-x}\text{As}$	$1.424 + 1.247x$
$\text{Al}_x\text{In}_{1-x}\text{As}$	$0.360 + 2.012x + 0.698x^2$
$\text{Al}_x\text{Ga}_{1-x}\text{Sb}$	$0.726 + 1.129x + 0.368x^2$
$\text{Al}_x\text{In}_{1-x}\text{Sb}$	$0.172 + 1.621x + 0.43x^2$
$\text{Ga}_x\text{In}_{1-x}\text{P}$	$1.351 + 0.643x + 0.786x^2$
$\text{Ga}_x\text{In}_{1-x}\text{As}$	$0.36 + 1.064x$
$\text{Ga}_x\text{In}_{1-x}\text{Sb}$	$0.172 + 0.139x + 0.415x^2$
$\text{GaP}_x\text{As}_{1-x}$	$1.424 + 1.150x + 0.176x^2$
$\text{GaAs}_x\text{Sb}_{1-x}$	$0.726 + 0.502x + 1.2x^2$
$\text{InP}_x\text{As}_{1-x}$	$0.360 + 0.891x + 0.101x^2$
$\text{InAs}_x\text{Sb}_{1-x}$	$0.18 + 0.41x + 0.58x^2$

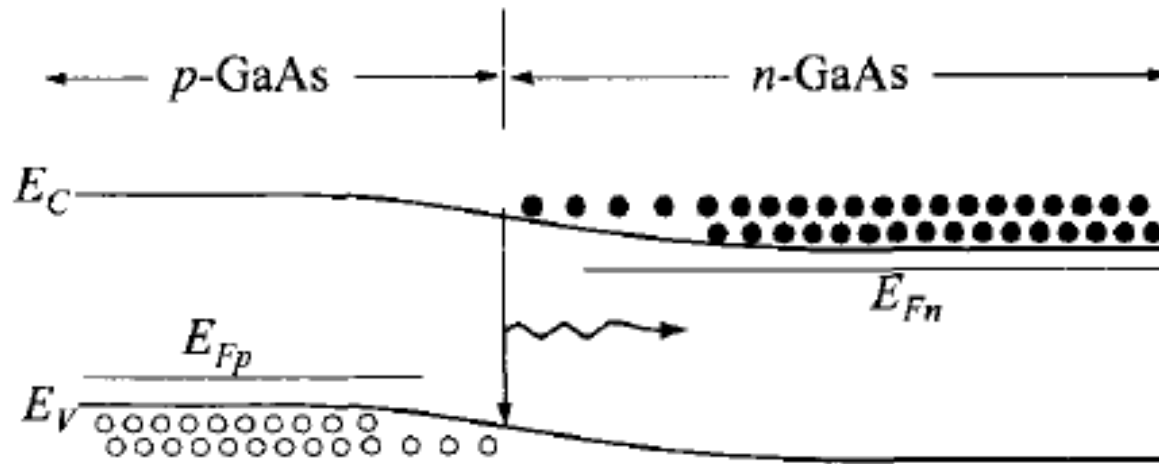
Table B.3: Compositional dependence of the energy gaps of the binary III-V ternary alloys at 300 K. (After Casey and Panish (1978).)

Một số loại LED

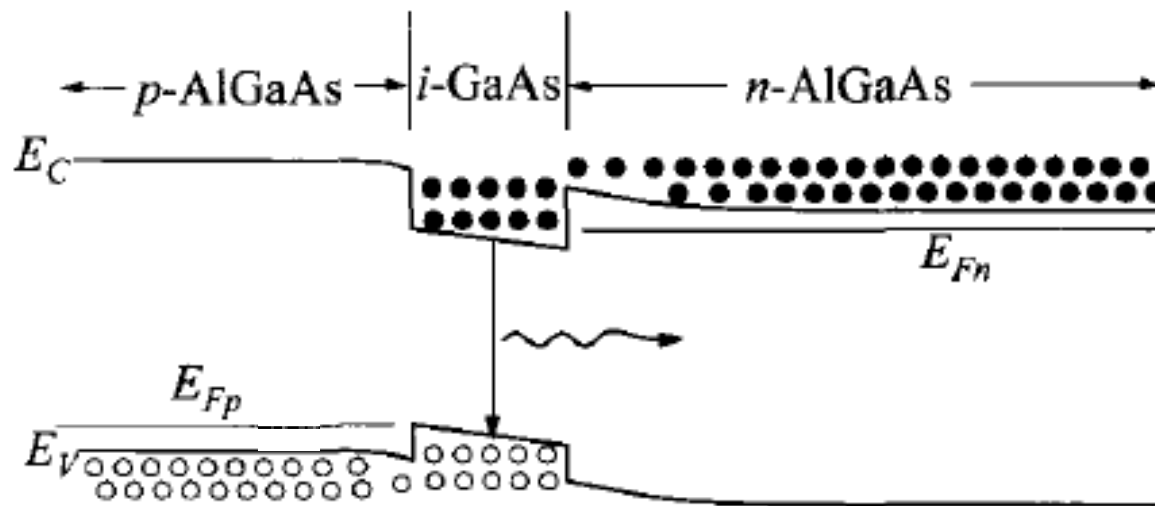
- LED di tiếp xúc
- LED phát xạ m t
- LED phát xạ c nh



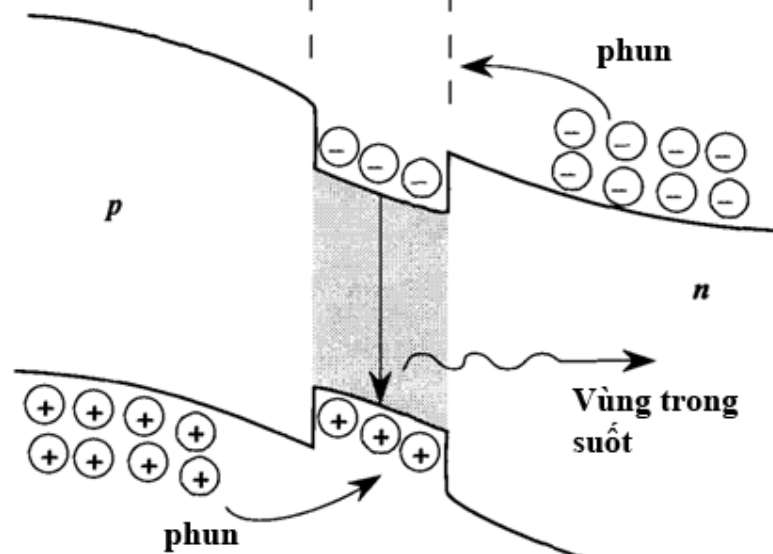
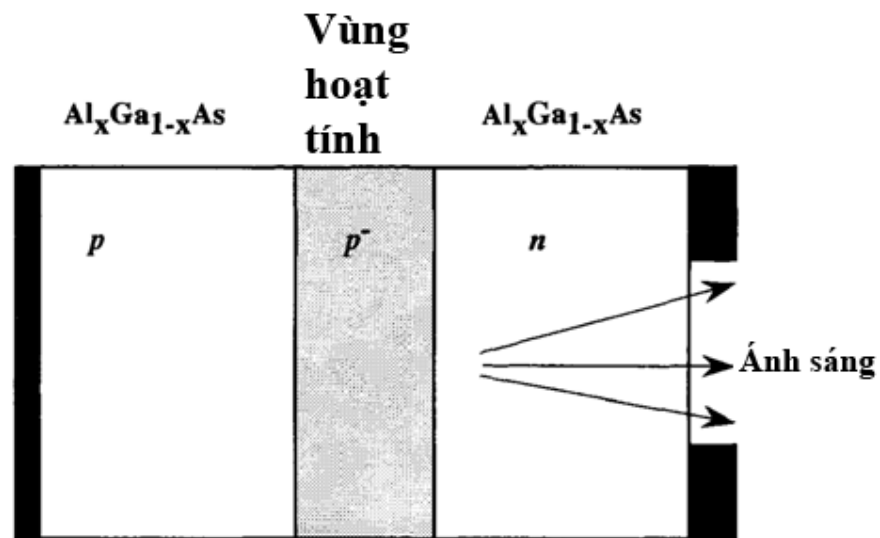
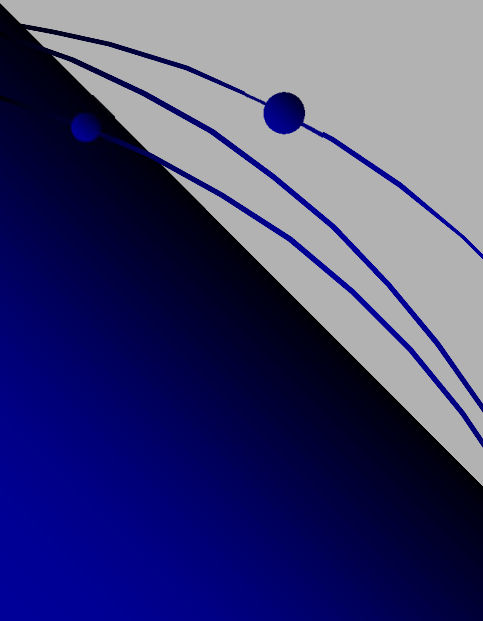
LED d ti p xúc

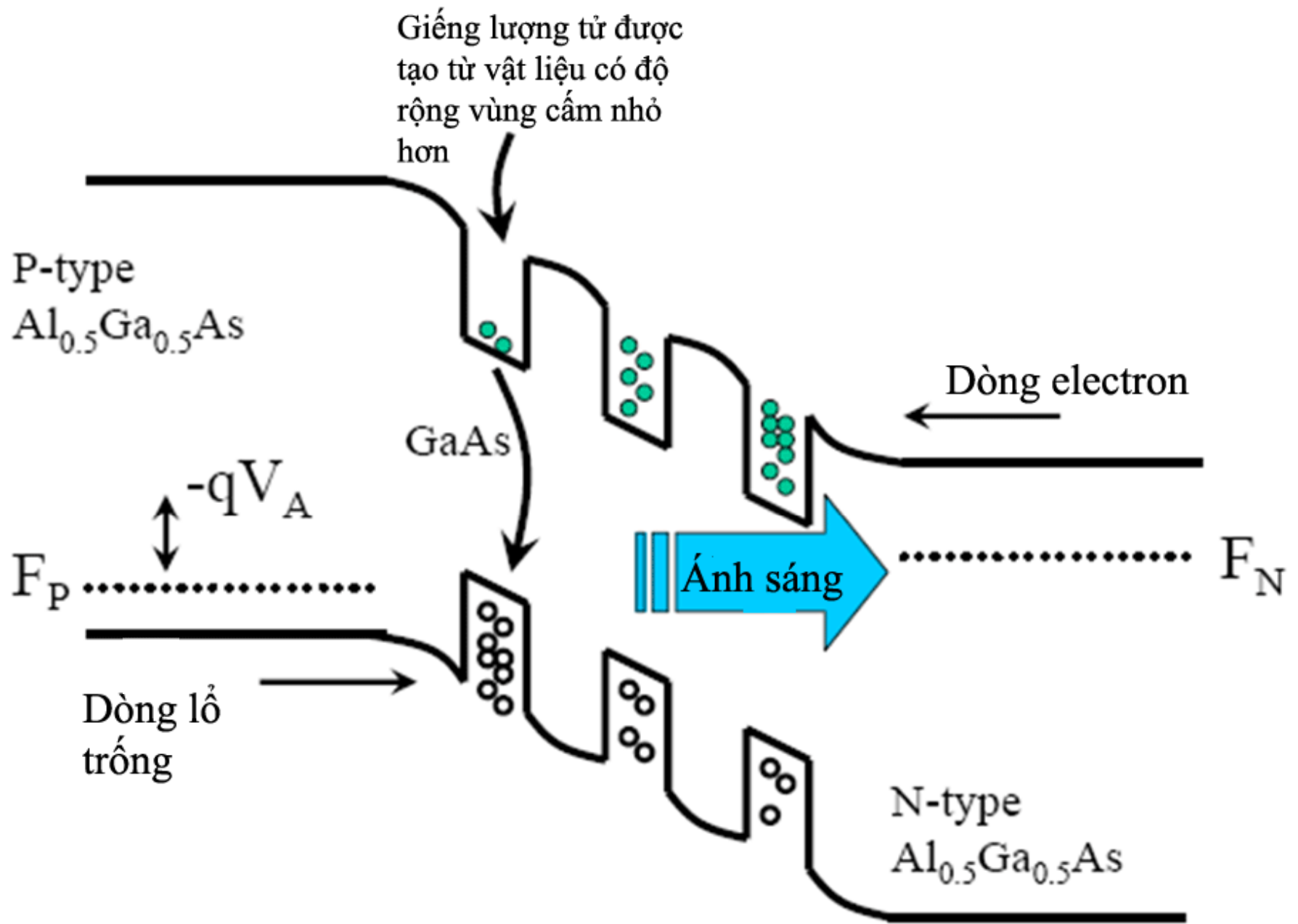


(a)

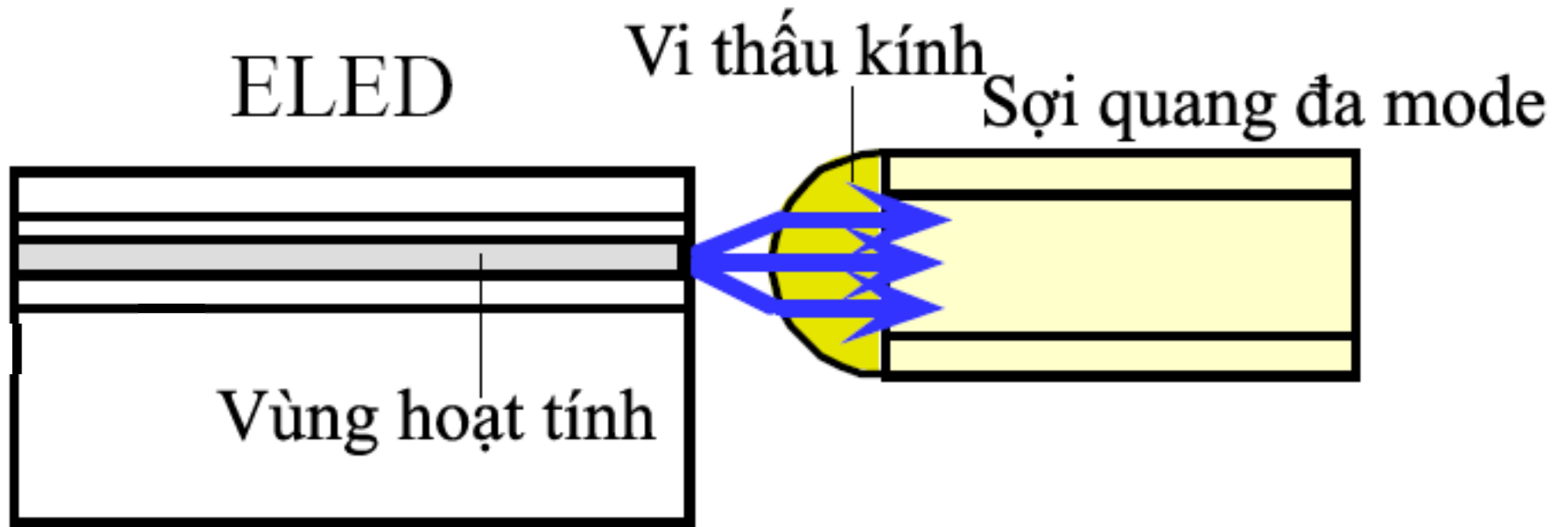


(b)



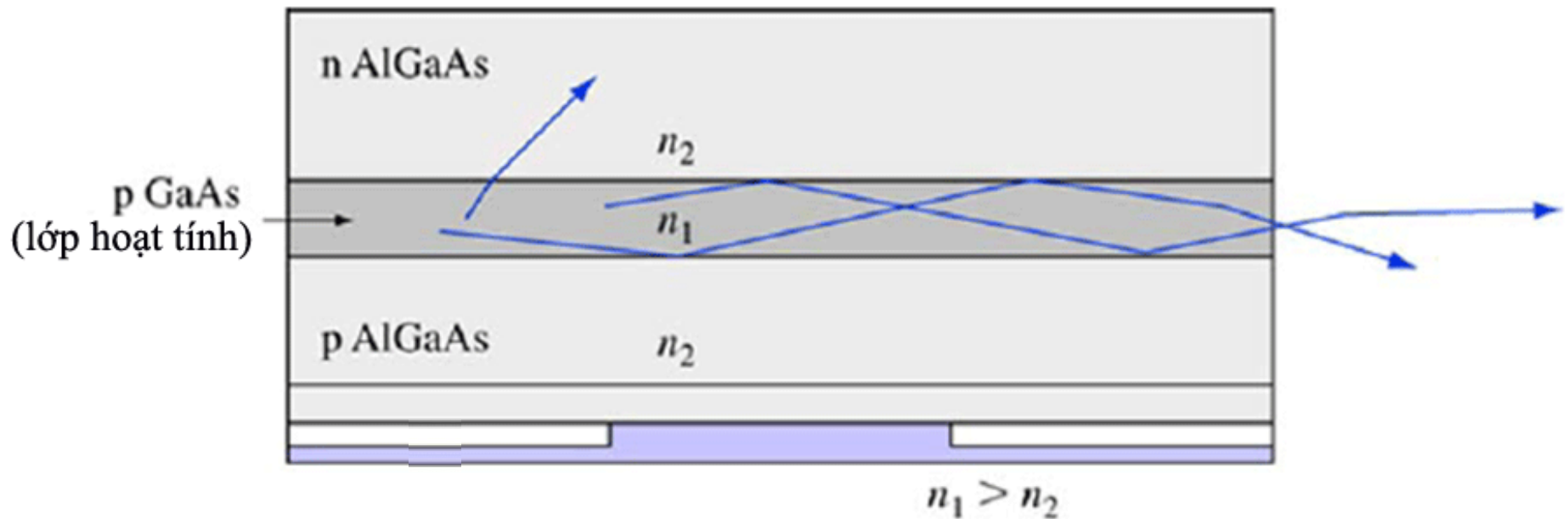


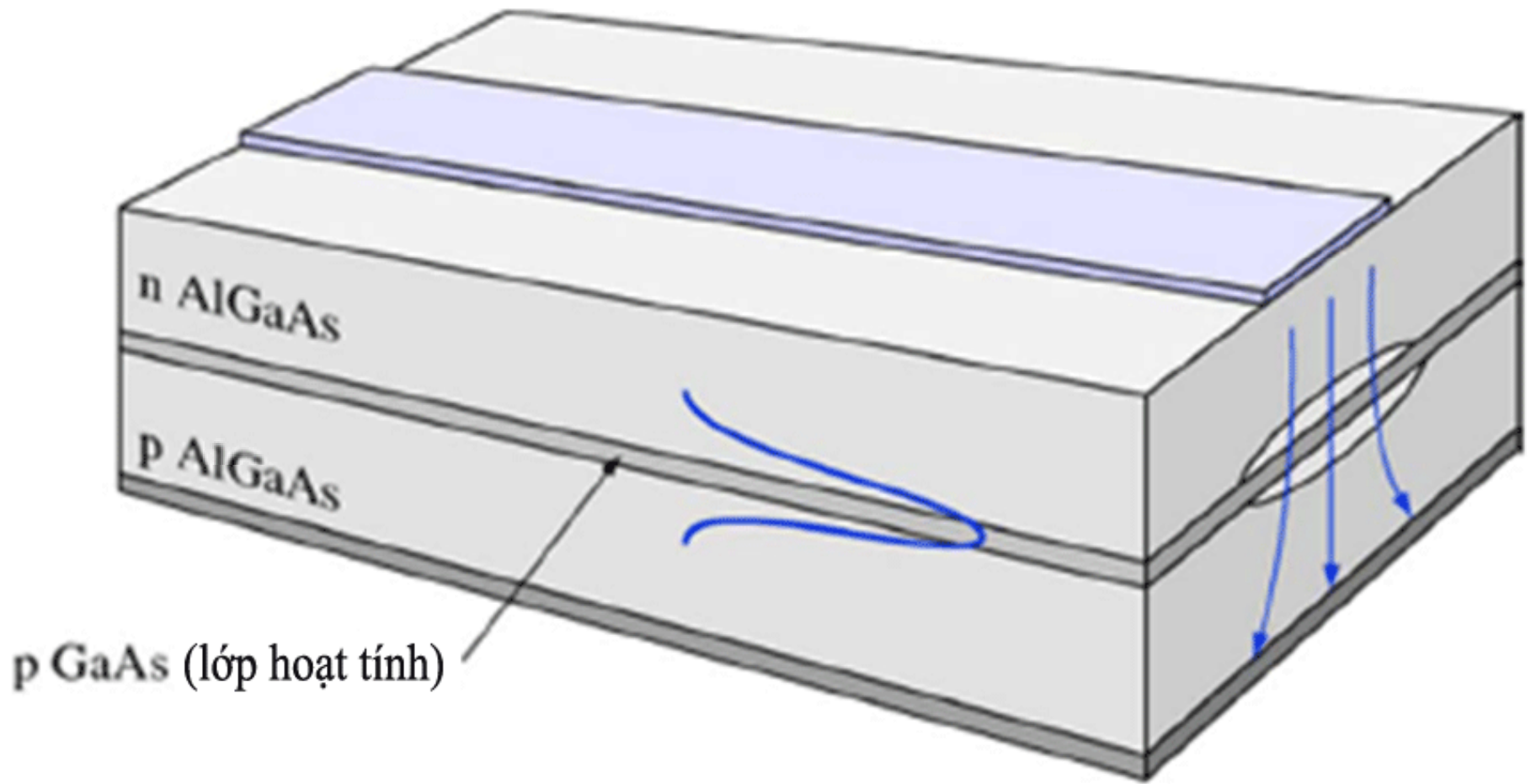
LED PHÁT X C NH



$$\theta_c = \sin^{-1} \left(\frac{n_2}{n_1} \right)$$

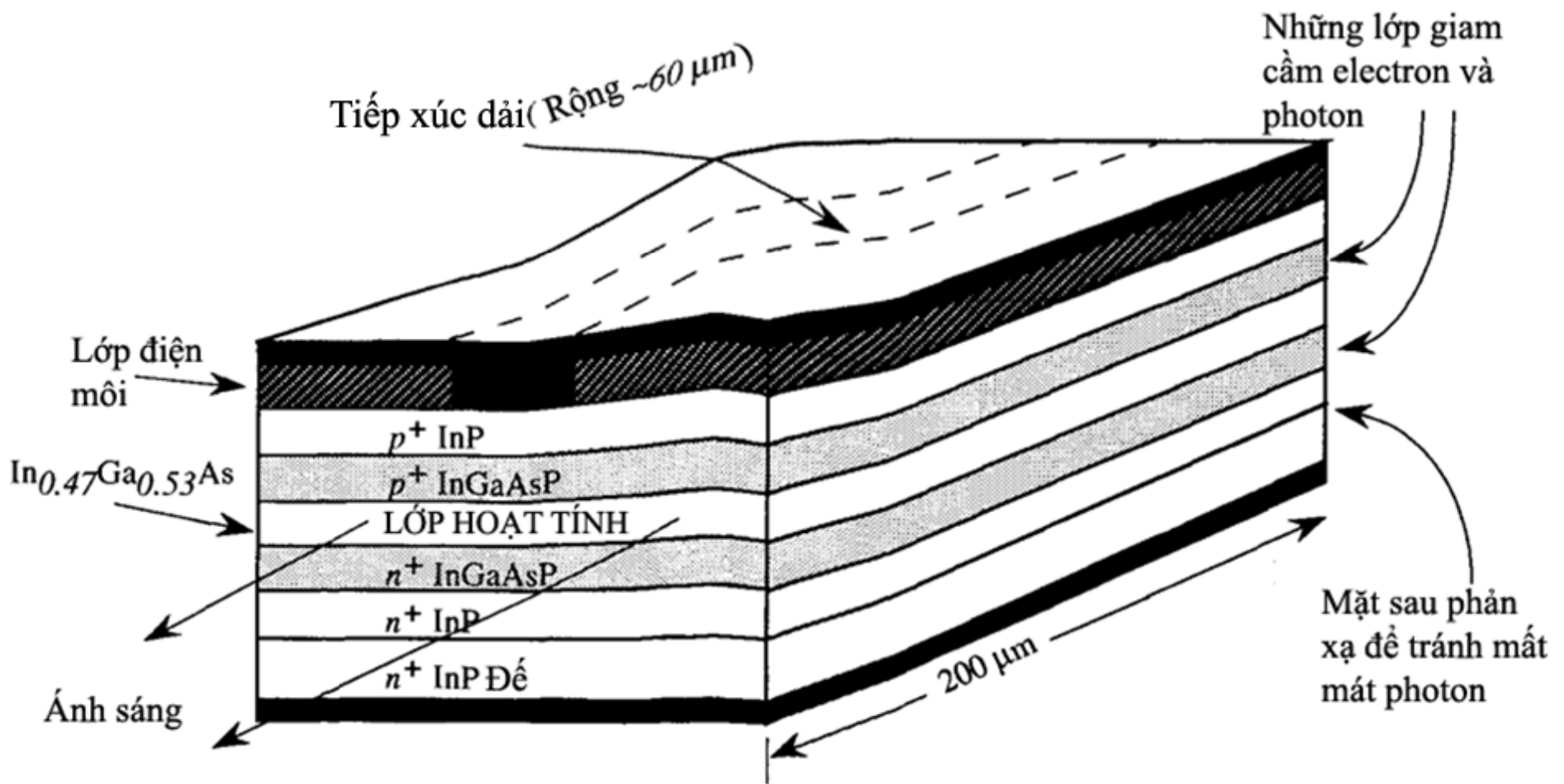
Ví dụ : GaAs ($n=3.66$) và GaP ($n=3.45$), góc giới hạn phản xạ toàn phần khoảng 16° - 17°



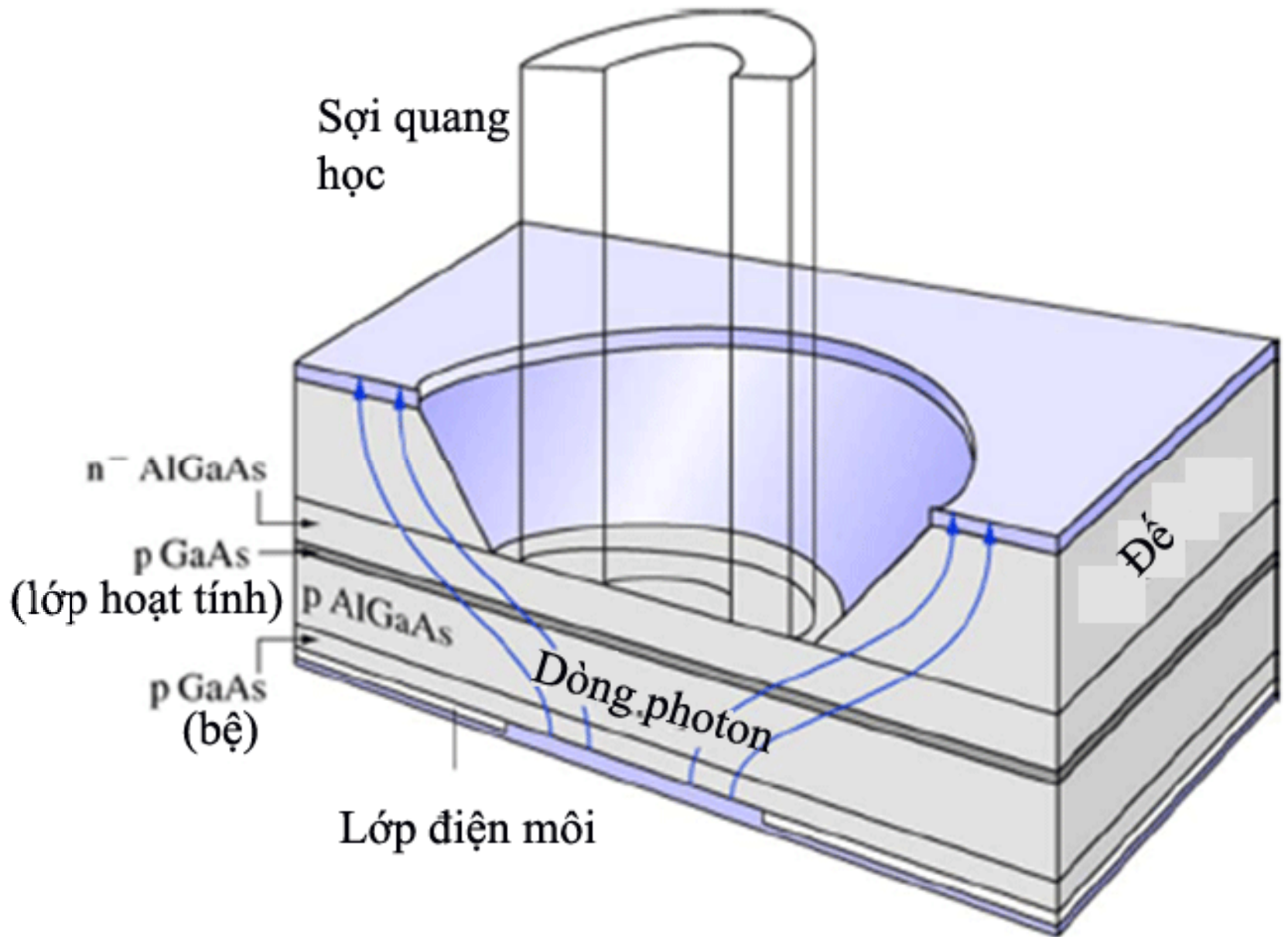


p GaAs (lớp hoạt tính)

Nguyên lý cấu tạo LED phát xạ ánh sáng trong thực tế



LED
phát
x
m t



S
nguyên
lí c a
LED
phát x
m t
trong
th c t

