بسمه‌تعالی

فرمول‌های میان ترم

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$E = h\nu$

$f(E) = \frac{1}{1+\exp[(E-E_f)/K_BT]}$

$g(E) = \frac{\sqrt{2}}{\pi^2}\left[\frac{m^*}{\hbar^2}\right]^{3/2}\sqrt{E}$

$n_0 = N_c e^{-(E_c-E_f)/K_BT}$

$N_c = 2\left[\frac{2\pi m_n^\star K_BT}{h^2}\right]^{\frac{3}{2}}$

$n_i = \sqrt{N_cN_v}e^{-E_g/2K_BT}$

$n_0 = n_i e^{(E_f-E_i)/K_BT}$

$\mu = \frac{v}{\varepsilon}$

$\mu = q\frac{\tau}{m}$

$\frac{D}{\mu} = \frac{K_BT}{q}$

$J_n = nq\mu_n\varepsilon + qD_n\frac{\partial n}{\partial x}$

$g_{th} = \alpha_r n_0 p_0$

$g = g_{th} + g_{opt}$

$\frac{dn}{dt} = \frac{\partial n}{\partial t} - \frac{1}{q}\frac{\partial}{\partial x}J_n$

$n = n_i e^{(F_n-E_i)/K_BT}$

$Si: E_g = 1.11eV, n_i = 1.5\times 10^{10}cm^{-3}$

$GaAs: E_g = 1.43eV, n_i = 10^6cm^{-3}, \epsilon_r = 13.2$

$m^* = \frac{\hbar^2}{\frac{\partial^2 E}{\partial k^2}}$

$f(E) = \frac{1}{K_BT}e^{\frac{-E}{K_BT}}$

$n = \int_{-\infty}^{+\infty} g(E)f(E)dE$

$p_0 = N_v e^{-(E_f-E_v)/K_BT}$

$N_v = 2\left[\frac{2\pi m_p^\star K_BT}{h^2}\right]^{\frac{3}{2}}$

$E_i = \frac{(E_c+E_v)}{2} + \frac{3}{4}K_BTln(\frac{m_p^*}{m_n^*})$

$p_0 = n_i e^{(E_i-E_f)/K_BT}$

$\sigma = \frac{J}{\varepsilon}$

$D = \frac{L^2}{2\tau}$

$I = I_0 e^{-\alpha t}$

$J_p = pq\mu_p\varepsilon - qD_p\frac{\partial p}{\partial x}$

$r = \alpha_r np$

$\tau = \frac{1}{\alpha_r(n_0+p_0)}$

$\frac{dp}{dt} = \frac{\partial p}{\partial t} + \frac{1}{q}\frac{\partial}{\partial x}J_p$

$p = n_i e^{(E_i-F_p)/K_BT}$

$Si: m_n^* = 1.08m_0, m_p^* = 0.56m_0, \epsilon_r = 11.8$