TEMA 2: Propiedades Fundamentales de los Semiconductores

- Ley de Acción de masas: $np = {n_i}^2$ siendo $n_i(T)$

- Ecuación de neutralidad: $p + N_D^+ = n + N_A^-$

- Densidad de portadores:

$$n = \left(\frac{N_D - N_A}{2}\right) + \sqrt{\left(\frac{N_D - N_A}{2}\right)^2 + {n_i}^2}$$

$$p = \left(\frac{N_A - N_D}{2}\right) + \sqrt{\left(\frac{N_A - N_D}{2}\right)^2 + {n_i}^2}$$

$$n_o = N_C\, exp\left[\frac{-(E_C - E_F)}{KT}\right]$$

$$p_o = N_V\, exp\left[\frac{-(E_F - E_V)}{KT}\right]$$

Con: $N_C = 2\left(\frac{2\pi m_n^* KT}{h^2}\right)^{3/2}$ y $N_V = 2\left(\frac{2\pi m_P^* KT}{h^2}\right)^{3/2}$

$$n_i = N_C\, exp\left[\frac{-\left(E_C - E_{F_i}\right)}{KT}\right]$$

$$p_i = N_V\, exp\left[\frac{-\left(E_{F_i} - E_V\right)}{KT}\right]$$

$$n_i = (N_C N_V)^{1/2} exp\left(\frac{-E_g}{2KT}\right)$$

$$n_o = n_i\, exp\left[\frac{E_F - E_{F_i}}{KT}\right]$$

$$p_o = n_i\, exp\left[\frac{E_{F_i} - E_F}{KT}\right]$$

$$E_{F_i} = \frac{1}{2}(E_C + E_V) + \frac{1}{2}KT\, Ln\left(\frac{N_V}{N_C}\right) = E_{midgap} + \frac{3}{4}KT\, Ln\left(\frac{{m^*}_p}{{m^*}_n}\right)$$

- Densidad de corriente:

$$\vec{J}_{TOTAL} = \left(qn\mu_n + qp\mu_p\right)\vec{E} + \left(qD_n\vec{\nabla}n - qD_p\vec{\nabla}p\right)$$