

Firstly, two equations describing the evolution of the point defects (vacancies and interstitials) are postulated:

$$\frac{dC_v}{dt} = Q_v - K_{iv}C_vC_i - K_{vN}(\rho_N)D_vC_v - K_{vL}(\pi C_I d_I)D_vC_v - k_{gb}^2 D_vC_v - \frac{4\pi a_0^2 D_vC_vC_{2i}}{\Omega} \quad (1)$$

$$\frac{dC_i}{dt} = Q_i - K_{iv}C_vC_i - K_{iN}(\rho_N)D_iC_i - K_{iL}(\pi C_I d_I)D_iC_i - k_{gb}^2 D_iC_i - 16\pi r_{iv}D_iC_i^2 + \frac{4\pi a_0^2 D_vC_vC_{2i}}{\Omega} \quad (2)$$

$$\frac{dC_{2i}}{dt} = Q_{2i} + 8\pi \frac{r_{iv}D_iC_i^2}{\Omega^2} - 4\pi \frac{r_{iv}D_iC_vC_{2i}}{\Omega} - \frac{\pi v_{2i}C_{2i}}{b_v} \quad (6)$$

$$\frac{d\rho_N}{dt} = f_1 \frac{|v_D|}{d_N} \pi d_I C_I - f_2 \frac{|v_N|}{d_N} \rho_N \quad (7)$$

$$\frac{dC_I}{dt} = \frac{\pi v_I C_{2i}}{2a_0} - \frac{4v_I C_I d_I}{d_N^2} - 8v_I d_I^2 C_I^2 - f_1 \frac{|v_D|}{d_N} C_I \quad (8)$$

$$\frac{d(d_I)}{dt} = v_I - (d_I - 2a_0) \frac{C_{2i \rightarrow I}}{C_I} (d_N - d_I) \frac{C_{I \rightarrow N}}{C_I} d_I \frac{C_{2I \rightarrow I_2}}{C_I} \quad (9)$$

$$d_n = C_A C_p \sqrt{\frac{\pi}{f_v \rho_n}} \quad (10)$$

Solving these equations, it is possible to obtain C_v , C_i , C_{2i} , ρ_N , C_I , d_N and d_I as functions of neutron irradiation time

So these are our unknowns

For all Equations :

$Q_v, Q_i, k_{iv}, k_{gb}, D_i, D_v, r_{iv}, a_0, \Omega, b_v, f_1, f_2, f_v, C_A C_p$ are constants and can be provided

k_{vN}, k_{iN} are function of ρ_n , where

$$k_{vn} = z_{vn} \rho_n$$

$$k_{in} = z_{in} \rho_n$$

$$k_{vl}, k_{il} \text{ are function of } C_l d_l$$

where

$$k_{vl} = z_{vl} \pi C_l d_l$$

$$k_{il} = z_{il} \pi C_l d_l$$

Where $z_{vn}, z_{vl}, z_{in}, z_{il}$ are constant

You can consider $Q_{2i}, v_D, v_N, z_i, z_v$ as constant at this time

v_{2i} is a function of $D_i C_i$

$$v_{2i} = \frac{1}{2b_v} D_i C_i$$

d_n is a function of ρ_n

$$d_n = C_A C_p \sqrt{\frac{\pi}{f_v \rho_n}}$$

$$v_l = \frac{2}{b_v} (z_i D_i C_i - z_v D_v C_v)$$

$$C_{2i \rightarrow I} = \frac{\pi v_{2i} C_{2i}}{2a_0} \quad (10)$$

$$C_{I \rightarrow N} = \frac{4v_l C_l d_l}{P_{sl} d_N^2} \quad (11)$$

$$C_{2I \rightarrow I_2} = 8v_l d_l^2 C_l^2 \quad (12)$$