Lec 14   Example

$\bar{\epsilon}_{hot} = \epsilon_{th} + \epsilon_o + \epsilon_{SFP} + \epsilon_{GFP}$

8 d weeks $\dot{f} = 2 \times 10^{13} \frac{f}{cm^2 \cdot s}$ $T_f = 1400$ $T_{rof} = 800k$

$\Delta\rho_o = 0.01$ $\beta_o = 5 \ mwd/kgu$ 5% enrichment

$M_{UO_2} = 0.05 \cdot 235 + 0.95 \cdot 238 + 2 \times 16 =$
269.9

$\beta = ? = \dfrac{\dot{f} t}{N_u}$ $N_u = \dfrac{\rho_{U_{O_2}} N_a}{M_{UO_2}}$ $N_a = \dfrac{(0.97}{269.9} \ 6.022 \times 10^{23} = 2.45 \times 10^{00} \ u/cm^3$

$\beta = \dfrac{(2.5 \times 10^{13})(2 \times 7 \times 24 \times 3600)}{2.45 \times 10^{00}} = 0.0012 \ FIMA$

$\epsilon_{th} = \alpha \Delta T = (11 \times 10^{-4})(1400 - 300) = 0.0121$

$\epsilon_o = \Delta\rho_o \left[exp\left(\dfrac{\beta \ln 0.01}{C_o \beta_{1/2}} \right) - 1 \right]$ $C_o \to T > 750C \to C_o = 1$

$\beta_o = \dfrac{5 \ mwd/kgu}{950} = 0.0053 \ FIMA$

$\epsilon_o = 0.01 \left[exp \left(\dfrac{0.0012 \ \ln 0.01}{1 (0.0053)} \right) - 1 \right] = -0.0065$

$\epsilon_{SFP} = 5.577 \times 10^{-2} \rho\beta$
$\qquad 5.577 \times 10^{-2} (10.97)(0.0012) = 7.34 \times 10^{-4}$

$\epsilon_{GFP} = 1.96 \times 10^{-28} \rho\beta (2800-T)^{11.73} exp\left(-0.0162 (2800-T) \right) exp\left(-17.8 \rho\beta \right)$

$\qquad \epsilon_{GFP} = 0.0002$

$\epsilon_{tot} = 0.0121 - 0.0065 + 7.34 \times 10^{-4} + 0.0002 = 0.0086$