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EXAM 1

3-2-17

33/100

(1) Question 1

-20, 10/30

Solution

a) The fissile Isotope in U_3Si_5 will be U-235 with the enrichment in the natural (unenriched) of 0.7%

b) Let find the

Necessary equation $N_{U_3Si_5} = q N_a \frac{\delta}{M_{U_3Si_5}}$

$$\Rightarrow q = \frac{N_{U_3Si_5} \times M_{U_3Si_5}}{N_a \times \delta} =$$

-14

$M_{U_3Si_5}$

c) U_3Si_5 can not be a potential fuel compare to U_3Si_2 because of its caracteristics and its properties that are poor for the making of the fuel.

-6, Which characteristics and properties?

Question 2

-12, 23/35

Solution

$\delta_{gap} = 80\ \mu m$ $R_f = 4.5\ mm$ $\delta_c = 0.6\ mm$ $LHR = 250\ W/cm$

$T_{cool} = 580K$ $h_{cool} = 2.5\ W/cm^2K$

$$* \quad T_{co} = \frac{LHR}{2\pi R_f h_{cool}} + T_{cool}$$

$$= \frac{250\ W/cm}{2 \times 3.14159 \times 0.45\ cm \times 2.5\ W/cm^2K} + 580K$$

$$= 615K$$

$$* \quad T_{c1} = \frac{LHR\ \delta_c}{2\pi R_f K_c} + T_{co}$$

$$= \frac{250\ W/cm \times 0.06\ cm}{2 \times 3.14159 \times 0.45\ cm \times 0.2\ W/cmK} + 615K$$

(K_c for U... table ... in HW3 ...

$$\simeq 642\ K$$

$$T_S = \frac{LHR}{2\pi R_f h_{gap}} + T_{CI}$$

$$\left(k_{gas} = A \times 10^{-6} T^{0.79}\right)$$

$$k_{He} = 16 \times 10^{-6} \times (642)^{0.79}$$

$$= 0.0026$$

$$h_{gap} = \frac{k_{He}}{\delta_{gap}} =$$

$$= \frac{0.0026}{0.008} = 0.325 \ w/cm^2 K$$

$$\Rightarrow T_S = \frac{250 \ w/cm}{2 \times 3.14159 \times 0.45 \times 0.325} + 642K$$

$$\Rightarrow \boxed{T_S = 914 K}$$

-1, math error. Ts = 958.2 K

b) maximum stress

$$E(\varepsilon_{rr} - \varepsilon_{\theta\theta}) = (1+\nu)(\sigma_{rr} - \sigma_{\theta\theta})$$

or

$$\sigma_\theta = \frac{\alpha_F E_F (LHR)}{16\pi(1-\nu_F)K_F}\left(1 - 3\frac{r^2}{R_F^2}\right)$$

$r = R_F$ (maximum)

$$\sigma_\theta = \frac{\alpha_F E_F (LHR)}{16\pi(1-\nu_F)k_F} \times 2$$

$$= \frac{7.5\times10^{-6}\,K^{-1} \times 246.7 \times 2}{16 \times 3.14159 \times (1-0.25) \times 0.2}$$

-3, LHR = 250

$$\rightarrow \boxed{\sigma_\theta = 493 \times 10^{-6}\ GPa}$$

c.) The stress will be ~~higher~~ higher in case of UO_2 because UO_2 exhibits a T_s > than the one for UN

-3, higher stress because thermal conductivity is much lower.

d.) $\sigma_{rr}(R_i) = -P$

and $\sigma_{rr}(R_o) = 0$

-5, These aren't really assumptions, they are boundary conditions. There are many other actual assumptions

Question 3

0/35

a.) Assumption

$$\sigma_{rr}(R_i) = -P$$

$$\sigma_{rr}(R_o) = 0$$