25/100

-22, 13/35

Q3) Solution:

pressure = 6 MPa

Avg radius = 5.6 mm

Cladding thickness = 0.6 mm

a) The assumptions made in the thin walled cylinder approximation for the stress state are:

→ We assume very small strains

→ we also assume isotropic material response

-3, Stress constant across wall thickness

b) All three components of the stress using the thin walled cylinder approximation are:

$$\bar{\sigma}_\theta = \frac{PR}{\delta} = 6\,MPa\left(\frac{0.56}{0.06}\right)$$

$$\sigma_\theta = 55.99 \simeq \boxed{60\ MPa}$$

$$\bar{\sigma}_z = \frac{PR}{2\delta} = 6\,MPa\left(\frac{0.56}{2\times 0.06}\right)$$

$$\bar{\sigma}_z = \boxed{27.99\ MPa}$$

$$\bar{\sigma}_r = -\frac{1}{2}P = -\frac{1}{2}\cdot 6\,MPa$$

$$\bar{\sigma}_r = \boxed{-3\ MPa}$$

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c) Using thin walled cylinder approximation for cladding is less accurate than that that of using thick wall approximation this is because we only care about steady state solution, consider axisymmetric, temperature is constant on z-direction and the thermal conductivity K is indepen-dent of temperature but in thick we do not assume more.

-10, Calculate stress at two radii using thick wall equations and see if constant and compare to answer from part b

d) solution:

$E = 70\ GPa$, $\nu = 0.41$

To find: Stress and Strain tensors.

$$C_{11} = E(1-\nu)/(1+\nu)(1-2\nu))$$

$$C_{11} = 70(1-0.41)/(1+0.41)(1-2\times0.41))$$

$$C_{11} = 70(0.59)/(1.41)(1-0.82)$$

$$C_{11} = 70(0.59)/0.2538$$

$$C_{11} = 162.7265\ GPa$$

$$C_{12} = 70(0.41)/(1.41)(1-0.82) = 113.08\ GPa$$

-4, Stress and strain not shown in tensor form

-5, Calculate strains from stress from part b

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Beda Kafley

Nuclear Engineering 947

Exam # 1

-18, 12/30

Q1) Solution.

Given:

U_3Si_5 as fuel material

Thermal conductivity = 12.5 W/mk

density = 7.5 grams of U/cm^3

a) The fissile material in U_3Si_5 is naturally occurring uranium which is Uranium-235.

Uranium-235

Uranium-235 would have enrichment in the natural (unenrichment) form of the fuel.

b)

-15

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c) Ranking of U_3Si_5 as a potential fuel compared to U_3Si_2 would be;

⇒ 1st choice =

2nd choice =

U_3Si_2 is better fuel material than U_3Si_5 because U_3Si_5 has much higher melting point than that of U_3Si_2.

→ Also, U_3Si_2 have the advantage of much higher heat conductivity than U_3Si_5 which cannot survive equally high temperature as of U_3Si_2.

-3, Uranium density?

-30, 0/30 No problem 2

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