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1) Coupon of Zr cladding  $3\text{cm} \times 3\text{cm} \times 1\text{mm}$  <sup>thickness</sup> mass =  $5.8\text{g}$

- corrosion occurring for 300 days, final mass =  $5.95\text{g}$

estimate oxide thickness ...

$$\text{area} = 3\text{cm} \times 3\text{cm} = 9\text{cm}^2 = 0.09\text{dm}^2$$

$$\Delta \text{mass} = 5.95 - 5.8 = 0.15\text{g} = 150\text{mg}$$

$$W = \frac{\Delta \text{mass}}{\text{area}} = \frac{150}{0.09} = 1667 \frac{\text{mg}}{\text{dm}^2}$$

$$\delta (\mu\text{m}) = \frac{W}{14.7} = \frac{1667}{14.7}$$

$$\boxed{\delta = 113 \mu\text{m}}$$

2) what is  $\delta$  ( $\mu\text{m}$ ) w/ Zr cladding in water @ 700K for 150 days?

$$\text{is } t > t^*$$

$$t^* = 6.62 \times 10^{-7} \exp\left(\frac{14949}{700}\right) = 17.15 \text{ days}$$

$$150 > 17$$

$$\checkmark t > t^*$$

$$\delta^* = 5.1 \exp\left(\frac{-550}{700}\right) = 2.32 \mu\text{m}$$

$$\delta = \delta^* + K_L (t - t^*)$$

$$K_L \left[ \frac{\mu\text{m}}{\text{ly}} \right] = 7.48 \times 10^6 \exp\left(\frac{-14500}{700}\right) = 0.131$$

$$\delta = 2.32 \mu\text{m} + 0.131 \frac{\mu\text{m}}{\text{ly}} (150 - 17.15) = \boxed{19.8 \mu\text{m}}$$

3) hydrogen pickup

$$C_H (\text{wt. ppm}) = \frac{2 f \delta f_{ox} f_{\text{FeO}}^0 \times \frac{m_H}{m_O}}{\left(t - \frac{\delta}{PBR}\right) f_{\text{metal}}} \times 10^6$$

$$\frac{2 (0.15) (80 \mu\text{m}) (5.68 \text{ g/cc}) (0.26) \frac{1}{16}}{\left(600 - \frac{80}{1.56}\right) 6.5} \times 10^6$$

from class

add to initial H concentration = 40 wt ppm  $\longleftrightarrow$  661 wt. ppm  $\rightarrow$  618 wt. ppm