
PROBLEM 8-15N QUESTION

Two-Zone Sintering Of An Annular Fuel Pellet

An initially annular UO_2 fuel pellet is put under operation at 600 W/cm with an outside surface temperature of 700°C. Assume sintering occurs reconfiguring the pellet with the linear power and outside surface temperature maintained constant.

QUESTIONS

- a) Draw a temperature-radius plot for the pellet before and after sintering (numerical values not required, but do illustrate relative magnitudes, i.e., a figure analogous to Fig. 8-16 showing T_{\max} , T_s , T_{f_0} , R_{v_i} , R_{v_f} , R_{s_i} , R_{s_f} , and R_{f_0} , where state i is at power but before sintering, and state f is at power but after sintering).

- b) What is the maximum pellet temperature achieved after sintering occurs?

You may assume a two-zone sintering model where:

$$T_{\text{sintering}} \equiv T_s = 1,800^\circ\text{C} ,$$

$$\rho_{\text{sintered}} \equiv \rho_s = 98\% \rho_{\text{TD}} .$$

Take the initial annual pellet, $\rho_i = 88\% \rho_{\text{TD}}$, and of dimensions:

$$D_{f_0} \text{ (outside fuel diameter)} = 9.5 \text{ mm} ,$$

$$D_v \text{ (void diameter or inside fuel diameter)} = 4.5 \text{ mm} .$$