
PROBLEM 8-12N QUESTION

Transient Fuel Pin Analysis

A PWR fuel pin experiences DNB followed by SCRAM with the resulting reduction of power. The transient begins with full power steady-state operation at time $t = 0.0$, followed by DNB with a decrease in the fluid film heat transfer coefficient at the outside surface of the fuel rod. The reactor power drops to 10% of initial power with SCRAM at $t = 4.0$ sec., which reflects both the decay heat and some delayed fission. This situation is assumed to remain constant during the time of interest for this calculation (less than 15 seconds).

The data to be used to describe the fuel rod follows:

dimensions (ft.):

$$r_f = 0.016958$$

$$r_{ci} = 0.017708$$

$$r_{co} = 0.020542$$

fuel linear heat rate (B/hr.ft):

$$45734.0 \text{ at } t = 0.0 \text{ to } 4.0 \text{ sec.}$$

$$4573.4 \text{ at } t = 4.0 \text{ to end of calculation}$$

thermal properties:

$$k_f = 1.15 \text{ B/hr.ft.F}$$
$$= 1.25 \text{ (sintered)}$$

$$p_f = 635.0 \text{ lbm/ft}^3$$
$$= 677.4 \text{ (sintered)}$$

$$c_f = 0.08 \text{ B/lbm.F}$$
$$= 0.08 \text{ (sintered)}$$

$$k_c = 10.0$$

$$p_c = 409.0$$

$$c_c = 0.08$$

$$h_{\text{gap}} = 1000 \text{ B/hr.ft.}^2\text{F}$$

$$\text{Sintering temperature, } T_s = 3,092.0^\circ\text{F}$$

boundary conditions:

$$T_b = 536.0 \text{ F}$$

$$h_f = 10000 \text{ B/hr.ft.}^2\text{F at } t = 0.0$$
$$= 100 \text{ from } t = 0.0 \text{ to end of calculation}$$

computational parameters:

$$\text{number of iterations between plots (NP)} = 100$$

$$\text{maximum number of iterations (MAX)} = 2500$$

$$\text{number of fuel nodes (N)} = 25$$

$$\text{total number of nodes (M)} = 29 \quad (4 \text{ clad nodes})$$

$$\text{time step in hours (DELTA)} = 0.000001388$$

$$\text{node of sintered radius (NS)} = 13$$

Output will be placed in BIN no. 422 at the user counter with the group identification printed on the cover sheet

student groups	A	B	C	D
identification	NE313A	NE313B	NE313C	NE313D
password	A313	B313	C313	D313

data format from listings on the following pages