Effect of Porosity

Purposely put porosity into UO_2

- ***Good - Reduces gross swelling***
- ***Bad - Reduces thermal conductivity***

Define;

$$P = \frac{\text{Volume of Pores}}{\text{Volume of Pores + Volume of Solid}}$$

Model of Heat Conductivity

(Figure 10.15)

Fraction of xsection area occupied by pore

$$k = P_c\, k_{(\text{Pore Tube})} + (1 - P_c)\, k_s$$

Fraction length occupied by pore tube

$$\frac{1}{k_{(poretube)}} = \frac{P_L}{k_p} + \frac{1 - P_L}{k_S}$$

This produces ;

$$k = k_s\,(1 - P^{2/3}) \qquad \text{where } P = P_c P_L$$

Radiation Transport (see figure 10.16)

$$k_p = k_g + 4\varepsilon\sigma l_y T^3$$

thermal conductivity of gas

Empirical (to account for the minimum)

$$k = (3.11 + 0.0272\,T)^{-1} + 5.39 \times 10^{-13}\,T^3$$