

Miscellaneous Mechanical Considerations

12.46 (a) This portion of the problem requests that we compute the modulus of elasticity for nonporous spinel given that $E = 240$ GPa for a material having 5 vol% porosity. Thus, we solve Equation 12.9 for E_0 , using $P = 0.05$, which gives

$$E_0 = \frac{E}{1 - 1.9P + 0.9P^2}$$

$$= \frac{240 \text{ GPa}}{1 - (1.9)(0.05) + (0.9)(0.05)^2} = 265 \text{ GPa} \quad (38.6 \times 10^6 \text{ psi})$$

(b) Now we are asked to determine the value of E at $P = 15$ vol% (i.e., 0.15). Using Equation 12.9 we get

$$E = E_0(1 - 1.9P + 0.9P^2)$$

$$= (265 \text{ GPa}) [1 - (1.9)(0.15) + (0.9)(0.15)^2] = 195 \text{ GPa} \quad (28.4 \times 10^6 \text{ psi})$$