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HW#19

11.32 Explain why ceramics are weaker in tension than in compression.
Ceramics are weaker in tension because internal flaws and porosity initiates and propagates cracks under tensile stresses, severely reducing the tensile strength. These flaws do not propagate under compressive stresses.

11.94 Calculate the thermal conductivities for ceramics at porosities of 1%, 5%, 10%, 20%, and 30% for $\boldsymbol{k_o = 0.7\ W/m-K}$.

Governing equation, $k = k_o(1-p)$
$k_o = 0.7\ W/m-K$
$@\ 1\%\ porosity, p = 0.01$
$k = 0.7\ W/m-K(1-0.01) = 0.693\ W/m-K$

Using the governing equation above:

$Thermal\ conductivity\ @\ p = 0.01, \boldsymbol{k = 0.693\ W/m-K}$

$Thermal\ conductivity\ @\ p = 0.05, \boldsymbol{k = 0.665\ W/m-K}$

$Thermal\ conductivity\ @\ p = 0.10, \boldsymbol{k = 0.63\ W/m-K}$

$Thermal\ conductivity\ @\ p = 0.20, \boldsymbol{k = 0.56\ W/m-K}$

$Thermal\ conductivity\ @\ p = 0.03, \boldsymbol{k = 0.49\ W/m-K}$

Web Problem W6-1
Estimate the elastic modulus of a particle composite with 47% wood particles and 53% sodium silicate (ss) matrix. $\boldsymbol{E_{ss} = 45\ GPa}$. and $\boldsymbol{E_{wood} = 10.8\ GPa}$.

Using the rule of mixture in the orientation of the fibers

$E_1 = x_m E_m + x_f E_f$

$E_1 = 0.47(10.8\ GPa) + 0.53(45\ GPa)$

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$\boldsymbol{E_1 = 28.93\ GPa}$

Using the rule of mixture perpendicular to the orientation of the fibers

$$E_2 = \frac{E_m E_f}{x_m E_f + x_f E_m}$$

$$E_2 = \frac{(45\ GPa)(10.8\ GPa)}{0.53(10.8\ Gpa) + 0.47(45\ GPa)}$$

$\boldsymbol{E_1 = 18.08\ GPa}$