

## Calculations

Material: kenaf fiber from stage 1

Young modulus = 41  $\rightarrow$  GPa

$d = 6.35 \text{ mm} \rightarrow 6.35 \times 10^{-3} \text{ m}$   $r = 3.175 \times 10^{-3} \text{ m} \rightarrow$  project module

$L = 20 \text{ cm} \rightarrow 0.2 \text{ m} \rightarrow$  project module

contaminant size  $R$

$0.1 - 2 \mu\text{m}$   $1 - 2 \text{ nm}$  } project module  
smaller than  $1 \text{ nm}$

$P = \text{porosity} = \# \text{ pores} \cdot V_{\text{pore}}$

$r_{\text{pore}} = 1 \times 10^{-9} \text{ m} \rightarrow$  needs to be smaller, change to multiply  $r_{\text{contaminant}} \times 0.17 = r_{\text{pore}}$

$$V_{\text{pore}} = \pi r^2 h$$

$$= \pi (7 \times 10^{-10})^2 (6.35 \times 10^{-3})$$

$$= 9.775 \times 10^{-21} \text{ m}^3$$

$\nwarrow$  diameter of fiber  
 $\nwarrow$  volume of fiber

$1 \times 10^{-9} \text{ m} \times 0.17 = 1.7 \times 10^{-10} \text{ m}$

$$V_{\text{fiber fiber}} = \pi (3.175 \times 10^{-3})^2 (0.2)$$

$$= 8.84 \times 10^{-6} \text{ m}^3$$

$\nwarrow$  length of fiber

$$P = \frac{(2.71 \times 10^{14}) (9.775 \times 10^{-21})}{8.84 \times 10^{-6}}$$

$$P = 0.30$$

$$\frac{8.84 \times 10^{-6}}{9.775 \times 10^{-21}}$$

$$= 9.04 \times 10^{14} \text{ max \# of pores}$$

we chose 0.30. max \# pores

$$= 0.30 \times 9.04 \times 10^{14}$$

$$E_{\text{effective}} = E(1-P)^n$$

$$= 41(1-0.30)^2$$

$$= 20.09 \text{ GPa}$$

$$\sigma_{y \text{ effective}} = \sigma_y (1-P)^n$$

$$= (130)(1-0.30)^2$$

$$= 210.7 \text{ MPa}$$

## Interpretations



