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Volume Fraction of Fiber Formulas

Calculators! Examples! Conversions!

List of 18 Volume Fraction of Fiber Formulas

Volume Fraction of Fiber

1) Critical Fiber Length

Open Calculator

fx $$l_c = \sigma_f \cdot \frac{d}{2 \cdot \tau_c}$$

ex $$10.5897\text{mm} = 6.375\text{MPa} \cdot \frac{10\text{mm}}{2 \cdot 3.01\text{MPa}}$$

2) Fiber Diameter given Critical Fiber Length

Open Calculator

fx $$d = \frac{l_c \cdot 2 \cdot \tau}{\sigma_f}$$

ex $$10\text{mm} = \frac{10.625\text{mm} \cdot 2 \cdot 3\text{MPa}}{6.375\text{MPa}}$$

3) Fiber-Matrix Bonding Strength given Critical Length of Fiber

Open Calculator

fx $$\tau = \frac{\sigma_f \cdot d}{2 \cdot l_c}$$

ex $$3\text{MPa} = \frac{6.375\text{MPa} \cdot 10\text{mm}}{2 \cdot 10.625\text{mm}}$$

4) Longitudinal Strength of Composite

Open Calculator

fx $$\sigma_{cl} = \tau_m \cdot (1 - V_f) + \sigma_f \cdot V_f$$

ex $$31.865\text{MPa} = 70.1\text{MPa} \cdot (1 - 0.6) + 6.375\text{MPa} \cdot 0.6$$

5) Tensile Strength of Fiber from Longitudinal Tensile Strength of Composite

Open Calculator

fx $$\sigma_f = \frac{\sigma_{cl} - \sigma_m \cdot (1 - V_f)}{V_f}$$

ex $$6.375\text{MPa} = \frac{31.825\text{MPa} - 70\text{MPa} \cdot (1 - 0.6)}{0.6}$$

6) Tensile Strength of Fiber given Critical Fiber Length

Open Calculator

fx $$\sigma_f = \frac{2 \cdot l_c \cdot \tau}{d}$$

ex $$6.375\text{MPa} = \frac{2 \cdot 10.625\text{mm} \cdot 3\text{MPa}}{10\text{mm}}$$

7) Tensile Strength of Matrix given Longitudinal Tensile Strength of Composite

Open Calculator

fx $$\sigma_m = \frac{\sigma_{cl} - \sigma_f \cdot V_f}{1 - V_f}$$

ex $$70\text{MPa} = \frac{31.825\text{MPa} - 6.375\text{MPa} \cdot 0.6}{1 - 0.6}$$

8) Volume Fraction of Fiber from EM of Composite (Longitudinal Direction)

Open Calculator

$$V_f = \frac{E_{CL} - E_m \cdot V_m}{E_f}$$

$$0.59995 = \frac{200.0\text{MPa} - 200.025\text{MPa} \cdot 0.4}{200\text{MPa}}$$

9) Volume Fraction of Fiber from EM of Composite (Transverse Direction)

Open Calculator

$$V_f = \frac{E_f}{E_{CT}} - \frac{V_m \cdot E_f}{E_m}$$

$$0.6 = \frac{200\text{MPa}}{200.01\text{MPa}} - \frac{0.4 \cdot 200\text{MPa}}{200.025\text{MPa}}$$

10) Volume Fraction of Fiber from Longitudinal Tensile Strength of Composite

Open Calculator

$$V_f = \frac{\sigma_m - \sigma_{cl}}{\sigma_m - \sigma_f}$$

$$0.6 = \frac{70\text{MPa} - 31.825\text{MPa}}{70\text{MPa} - 6.375\text{MPa}}$$

11) Volume Fraction of Matrix from E of Composite (Longitudinal Direction)

Open Calculator

fx $$V_m = \frac{E_{CL} - E_f \cdot V_f}{E_m}$$

ex $$0.39995 = \frac{200.0\text{MPa} - 200\text{MPa} \cdot 0.6}{200.025\text{MPa}}$$

12) Volume Fraction of Matrix from EM of Composite (Transverse direction)

Open Calculator

fx $$V_m = \frac{E_m}{E_{CT}} - \frac{E_m \cdot V_f}{E_f}$$

ex $$0.4 = \frac{200.025\text{MPa}}{200.01\text{MPa}} - \frac{200.025\text{MPa} \cdot 0.6}{200\text{MPa}}$$

Elastic Modulus

13) Elastic Modulus of Composite in Longitudinal Direction

Open Calculator

fx $$E_{CL} = E_m \cdot V_m + E_f \cdot V_f$$

ex $$200.01\text{MPa} = 200.025\text{MPa} \cdot 0.4 + 200\text{MPa} \cdot 0.6$$

14) Elastic Modulus of Composite in Transverse Direction

Open Calculator

fx $$E_{CT} = \frac{E_m \cdot E_f}{V_m \cdot E_f + V_f \cdot E_m}$$

ex $$200.01\text{MPa} = \frac{200.025\text{MPa} \cdot 200\text{MPa}}{0.4 \cdot 200\text{MPa} + 0.6 \cdot 200.025\text{MPa}}$$

15) Elastic Modulus of Fiber using Composite (Transverse Direction)

Open Calculator

fx $$E_f = \frac{E_{CT} \cdot E_m \cdot V_f}{E_m - E_{CT} \cdot V_m}$$

ex $$200\text{MPa} = \frac{200.01\text{MPa} \cdot 200.025\text{MPa} \cdot 0.6}{200.025\text{MPa} - 200.01\text{MPa} \cdot 0.4}$$

16) Elastic Modulus of Fiber using Composite's Longitudinal Direction

Open Calculator

fx $$E_f = \frac{E_{CL} - E_m \cdot V_m}{V_f}$$

ex $$199.9833\text{MPa} = \frac{200.0\text{MPa} - 200.025\text{MPa} \cdot 0.4}{0.6}$$

17) Elastic Modulus of Matrix using Composite (Transverse Direction)

Open Calculator

fx $$E_m = \frac{E_{CT} \cdot E_f \cdot V_m}{E_f - E_{CT} \cdot V_f}$$

ex $$200.025\text{MPa} = \frac{200.01\text{MPa} \cdot 200\text{MPa} \cdot 0.4}{200\text{MPa} - 200.01\text{MPa} \cdot 0.6}$$

18) Elastic Modulus of Matrix using Composite's Longitudinal Direction

Open Calculator

fx
$$E_m = \frac{E_{CL} - E_f \cdot V_f}{V_m}$$

ex
$$200\text{MPa} = \frac{200.0\text{MPa} - 200\text{MPa} \cdot 0.6}{0.4}$$

Variables Used

- **d** Fiber Diameter *(Millimeter)*
- **E_{CL}** Elastic Modulus Composite (Longitudinal Direction) *(Megapascal)*
- **E_{CT}** Elastic Modulus Composite (Transverse Direction) *(Megapascal)*
- **E_f** Elastic Modulus of Fiber *(Megapascal)*
- **E_m** Elastic Modulus of Matrix *(Megapascal)*
- **l_c** Critical Fiber Length *(Millimeter)*
- **V_f** Volume Fraction of Fiber
- **V_m** Volume Fraction of Matrix
- **σ_{cl}** Longitudinal Strength of Composite *(Megapascal)*
- **σ_f** Tensile Strength of Fiber *(Megapascal)*
- **σ_m** Tensile Strength of Matrix *(Megapascal)*
- **τ** Fiber-Matrix Bonding Strength *(Megapascal)*
- **τ_c** Critical Shear Stress *(Megapascal)*
- **τ_m** Stress in Matrix *(Megapascal)*

Constants, Functions, Measurements used

- Measurement: **Length** in Millimeter (mm)
  Length Unit Conversion
- Measurement: **Pressure** in Megapascal (MPa)
  Pressure Unit Conversion

Check other formula lists

- **Rolling Process Formulas**
- **Volume Fraction of Fiber Formulas**

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