

Calculator in Fiber drawing

Calculation is based on a volume of a cylinder passing the oven

$$V = \pi r^2 h$$

The volume should be constant

$$\pi r_{fiber}^2 h_{fiber} = \pi r_{preform}^2 h_{preform}$$

Eliminate π

$$r_{fiber}^2 h_{fiber} = r_{preform}^2 h_{preform}$$

Move to diameter

$$\left(\frac{D}{2}\right)_{fiber}^2 h_{fiber} = \left(\frac{D}{2}\right)_{preform}^2 h_{preform}$$

$$\left(\frac{D^2}{4}\right)_{fiber} h_{fiber} = \left(\frac{D^2}{4}\right)_{preform} h_{preform}$$

$$D_{fiber}^2 h_{fiber} = D_{preform}^2 h_{preform}$$

Calculation, SI units

Preform speed

$$h_{preform} = \frac{D_{fiber}^2 h_{fiber}}{D_{preform}^2}$$

Preform diameter

$$D_{preform} = \sqrt{\frac{D_{fiber}^2 h_{fiber}}{h_{preform}}}$$

Fiber speed

$$h_{fiber} = \frac{D_{preform}^2 h_{preform}}{D_{fiber}^2}$$

Fiber diameter

$$D_{fiber} = \sqrt{\frac{D_{preform}^2 h_{preform}}{h_{fiber}}}$$

Calculation, non SI units

Preform speed *

$$h, mm/min_{preform} = \frac{1000^2 * D, \mu m_{fiber}^2 * h, m/min_{fiber}}{1000^2 * D, mm/min_{preform}^2 * 1000}$$

$$h, mm/min_{preform} = \frac{D, \mu m_{fiber}^2 * h, m/min_{fiber}}{D, mm/min_{preform}^2 * 1000}$$

Preform diameter *

$$D, mm_{preform} = \sqrt{\frac{1000^2 * D, \mu m_{fiber}^2 * h, m/min_{fiber}}{1000 * h, mm/min_{preform}}} / 1000$$

$$D, mm_{preform} = \sqrt{\frac{1000 * D, \mu m_{fiber}^2 * h, m/min_{fiber}}{h, mm/min_{preform}}} / 1000$$

Fiber speed *

$$h, m/min_{fiber} = \frac{1000^2 * D, mm/min_{preform}^2 * 1000 * h, mm/min_{preform}}{1000^2 * D, \mu m_{fiber}^2}$$

$$h, m/min_{fiber} = \frac{1000 * D, mm/min_{preform}^2 * h, mm/min_{preform}}{D, \mu m_{fiber}^2}$$

Fiber diameter *

$$D, \mu m_{fiber} = \sqrt{\frac{1000^2 * D, mm_{preform}^2 * 1000 * h, mm/min_{preform}}{h, m/min_{fiber}}} / 1000$$

$$D, \mu m_{fiber} = \sqrt{\frac{1000^3 * D, mm_{preform}^2 * h, mm/min_{preform}}{h, m/min_{fiber}}} / 1000$$

Sample, non SI units

Fiber diameter = 90 μm ; fiber speed = 80 m/min; preform diameter = 27 mm

Preform speed =

$$h_{preform} = \frac{90, \mu m_{fiber}^2 * 80, m/min_{fiber}}{27, mm/min_{preform}^2 * 1000} = \frac{8100 * 80}{729 * 1000} = 0.889 mm/min$$