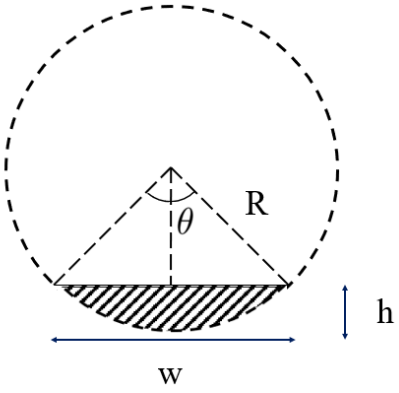
Formula derivation:



Area calculation for given height h and width w
Calculation for R:

$$R^2 = (R-h)^2 + \frac{w^2}{4}$$
$$\implies R^2 = R^2 + h^2 - 2Rh + \frac{w^2}{4}$$
$$\implies R^2 = \frac{h^2 + \frac{w^2}{4}}{2h} = \frac{w^2 + 4h^2}{8h}$$

When $h < R$, Area (A) =

$$(\frac{\theta}{2\pi})(\frac{\pi R^2}{4}) - \frac{1}{2}w(h-R)$$
$$sin\frac{\theta}{2} = \frac{(\frac{w}{2})}{R}$$
$$\theta = 2sin^{-1}\frac{w}{D}$$

When $h > R$, A =

$$\pi R^2 - ((\frac{\theta}{2\pi})(\frac{\pi R^2}{4}) - \frac{1}{2}w(h-R))$$
$$where,\ \theta = 2sin^{-1}\frac{w}{D}$$

Sample Calculations

Fused zone: Width (w) = 2.578mm Depth (h) = 1.893mm

For calculating area, we need to first find the radius of the circle for which this depth and height are part of:

$$So,\ R^2 = \frac{w^2 + 4h^2}{8h} = \frac{(2.578)^2 + 4(1.893)^2}{8(1.893)} = 1.289mm$$

Since $h > R$, Area

$$\pi R^2 - ((\frac{\theta}{2\pi})(\frac{\pi R^2}{4}) - \frac{1}{2}w(h-R))$$
$$\theta = 2sin^{-1}\frac{w}{D} = 1.1956$$
$$A_2 = \pi(1.289)^2 - ((\frac{(1.1956}{2\pi})(\frac{\pi(1.289)^2}{4}) - \frac{1}{2}(2.578)(1.893-1.289))$$
$$A_2 = 3.08039mm^2$$

For melt pod, Width (w) = 1.2mm Depth (h) = 1.2mm

$$So,\ R^2 = \frac{w^2 + 4h^2}{8h} = \frac{(1.2)^2 + 4(1.2)^2}{8(1.2)} = 0.75mm$$

Since $h > R$, Area =

$$\pi R^2 - ((\frac{\theta}{2\pi})(\frac{\pi R^2}{4}) - \frac{1}{2}w(h-R))$$
$$A_1 = 1.51554mm^2$$

Dilution % =

$$\frac{A_2}{A_1 + A_2} = \frac{3.08039}{1.51554 + 3.08039} * 100$$
$$\implies Dilution\% = 67.024$$