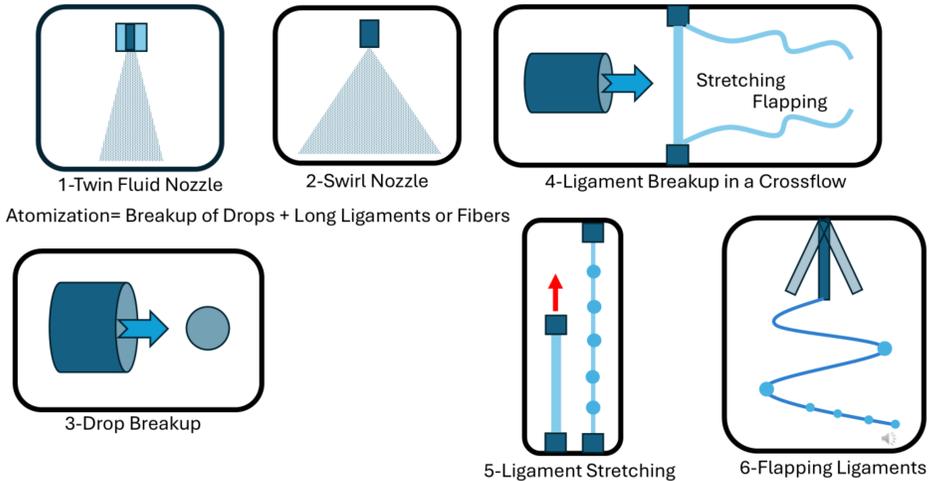


A MODEL FOR THE SPRAY SIZE DISTRIBUTION IN SWIRL NOZZLES

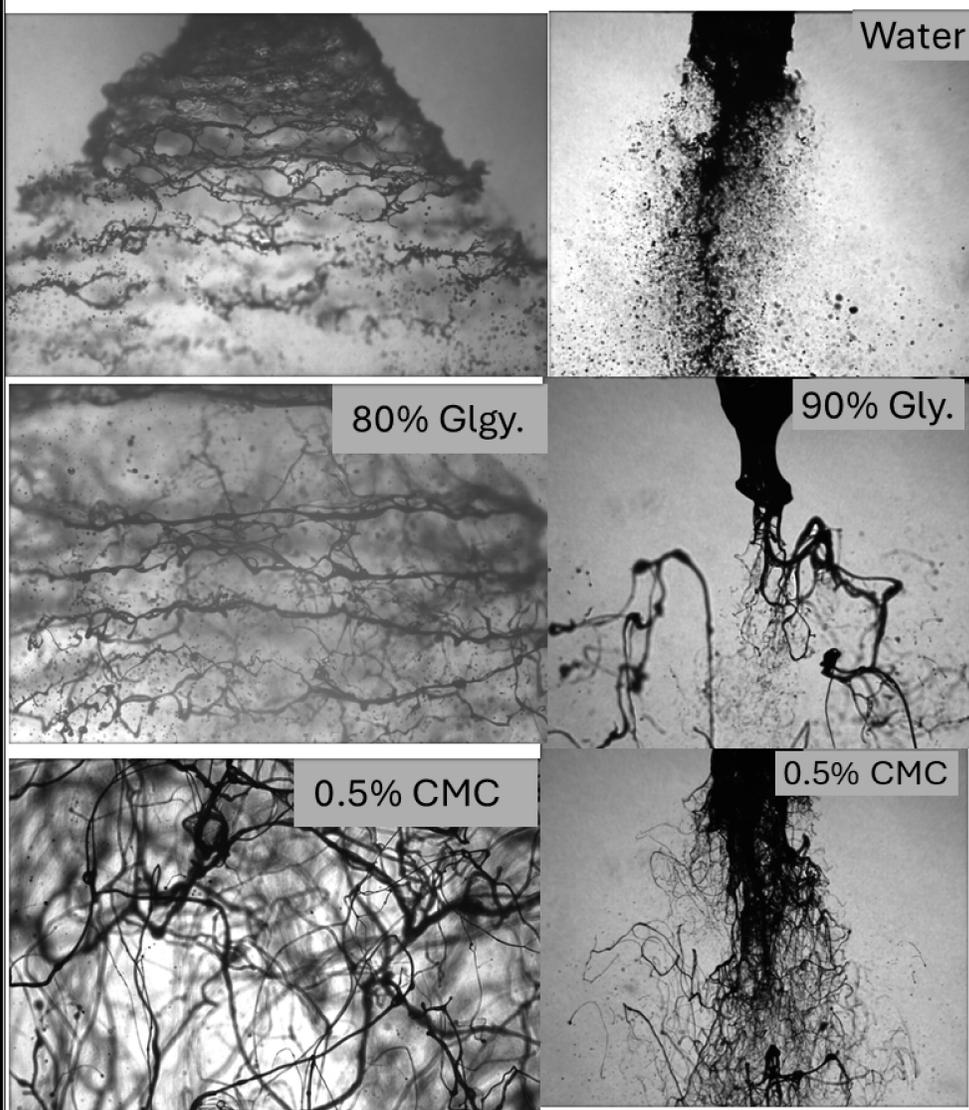
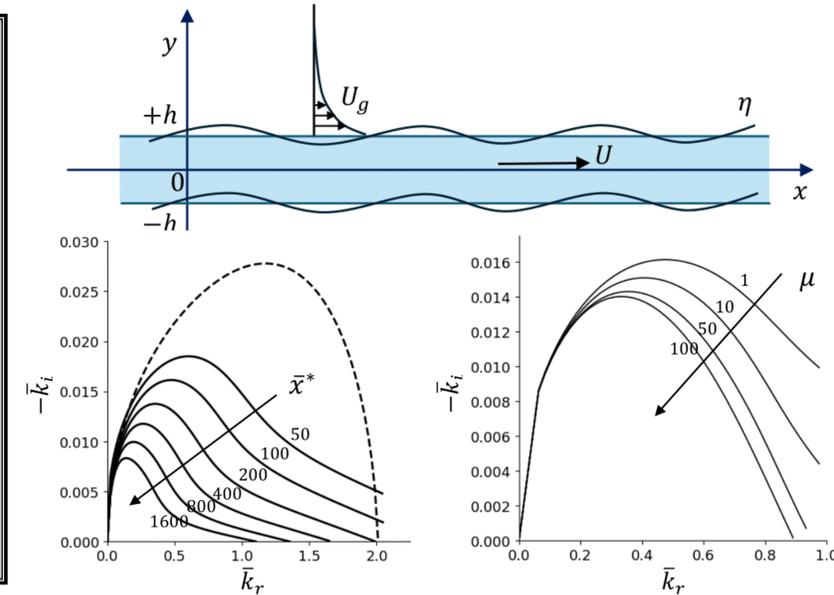
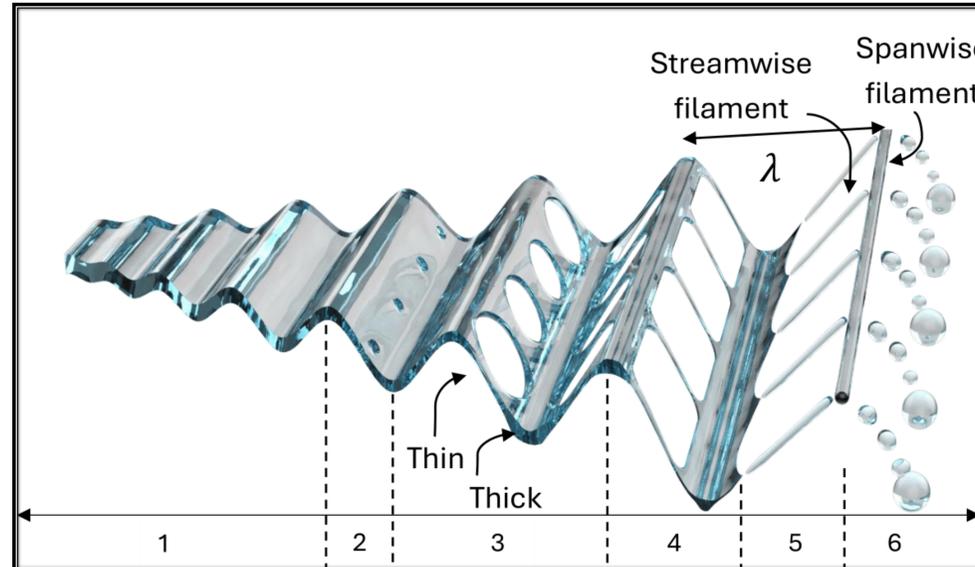
Nasser Ashgriz & Jerry Chen

BACKGROUND

Review: Experiments



Perforated Sheet Atomization Model (PSAM)



1. Calculate sheet velocity, U , knowing injection pressure: $U = 0.7\sqrt{2p/\rho}$
2. Calculate sheet thickness at the orifice t_{or} , knowing mass flow and spray cone angle:

$$t_{or} = \frac{d_{or}}{2} - \sqrt{\frac{d_{or}^2}{4} - \frac{\dot{m}}{\rho\pi U \cos\theta}}$$
3. Calculate the breakup length L_b and λ :

$$\frac{L_b}{t_{or}} = 33.5 \alpha^{-2/3} We^{-1/3} Re^{-1/6}$$

$$\frac{\lambda}{t_{or}} = 0.7 We^{-1/5} \left(\frac{L_b}{t_{or}}\right)$$
4. Calculate streamwise filament thickness $d_s = \sqrt{\lambda h_f}$

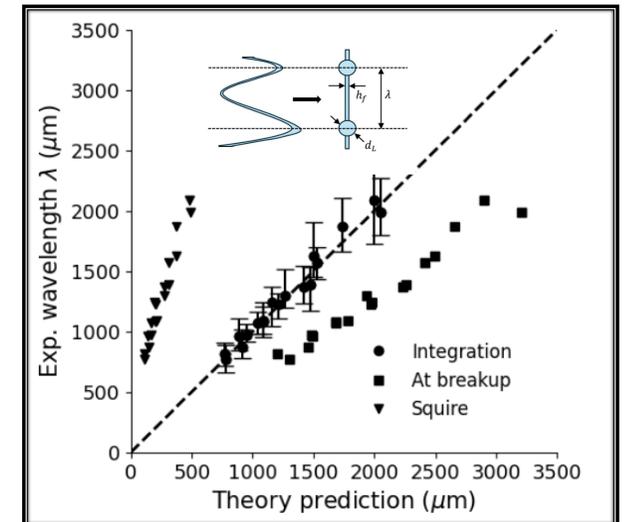
5. Calculate the initial spanwise filament thickness d_L :

$$\frac{\pi}{4} d_L^2 = \frac{\dot{m} \lambda}{2\pi\rho U L_b \sin\theta} - \lambda h_f, h_f = 1.85 \mu m$$
6. Calculate the spanwise filament thickness $d_{L,b}$ after stretching

$$d_{L,b} = d_L \sqrt{1 + l/L_b}$$
7. Determine the volume ratio between two types of filaments:

$$f = d_s^2 / (d_s^2 + \lambda h_f)$$
8. The droplet size distribution:

$$p_{m,n} \left(x = \frac{d_p}{\langle d_p \rangle}\right) = \frac{2(mn)^{\frac{m+n}{2}} x^{\frac{m+n}{2}-1}}{\Gamma(m)\Gamma(n)} K_{m-n}(2\sqrt{mn}x)$$



COMPARISON WITH EXPERIMENTS

