Weekly Progress Report

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1 Major Tasks

1. Reading the Research Papers (Semi Lee, Jaeki Lee, Gates).
2. FEniCS.
3. Silver Nanowire Project.
   - Integrating equations of analytic 1-D Visco-Capillary model by using Python.

2 Works Completed

1. DMAP experiment with KA.

3 Works in Progress

1. Following up the Cox's Paper.

2. Model for processes with vacuum.

Total Result for the uniform die lip geometry. $h(x) = H_0$ =constant

$$
\begin{aligned}
\frac{P_{\mathrm{amb}} - P_{\mathrm{d}}}{\mu V_{\mathrm{w}}/H_0} &= 1.34\frac{R_{\mathrm{gt}}}{N_{\mathrm{Ca}}^{1/3}} \\
\frac{P_{\mathrm{d}} - P_{\mathrm{u}}}{\mu V_{\mathrm{w}}/H_0} &= 6[\frac{L_{\mathrm{d}}}{H_0}(1-\frac{2}{R_{\mathrm{gt}}}) + \frac{L_{\mathrm{u}}}{H_0}] && \mathit{Weeping} \\
\frac{P_{\mathrm{d}} - P_{\mathrm{u}}}{\mu V_{\mathrm{w}}/H_0} &= 6[\frac{L_{\mathrm{d}}}{H_0}(1-\frac{2}{R_{\mathrm{gt}}})] && \mathit{BeadBreak-up} \\
\frac{P_{\mathrm{u}} - P_{\mathrm{vac}}}{\mu V_{\mathrm{w}}/H_0} &= -\frac{1}{N_{\mathrm{Ca}}}(\cos(\theta_{\mathrm{s}}) + \cos(\theta_{\mathrm{d}}))
\end{aligned}
$$

Total Sum for Weeping

$$
0 = 6\left[\frac{L_{\mathrm{d}}}{H_0}(1-\frac{2}{R_{\mathrm{gt}}}) + \frac{L_{\mathrm{u}}}{H_0}\right] N_{\mathrm{Ca}} + 1.34 R_{\mathrm{gt}} N_{\mathrm{Ca}}^{2/3} - [\cos(\theta_s) + \cos(\theta_d) + \frac{H_0}{\sigma}(P_{\mathrm{amb}} - P_{\mathrm{vac}})]
$$

Total Sum for Bead Break-up

$$
0 = 6\left[\frac{L_{\mathrm{d}}}{H_0}(1-\frac{2}{R_{\mathrm{gt}}})\right] N_{\mathrm{Ca}} + 1.34 R_{\mathrm{gt}} N_{\mathrm{Ca}}^{2/3} - [\cos(\theta_s) + \cos(\theta_d) + \frac{H_0}{\sigma}(P_{\mathrm{amb}} - P_{\mathrm{vac}})]
$$

$ax^3 + bx^2 - c = 0$ for $x = N_{\mathrm{Ca}}^{1/3}$

$$
\begin{aligned}
x &= -\frac{\sqrt[3]{\frac{\sqrt{\left(-\frac{27c}{a}+\frac{2b^3}{a^3}\right)^2 - \frac{4b^6}{a^6}}}{2} - \frac{27c}{2a} + \frac{b^3}{a^3}}}{3} - \frac{b}{3a} - \frac{b^2}{3a^2\sqrt[3]{\frac{\sqrt{\left(-\frac{27c}{a}+\frac{2b^3}{a^3}\right)^2 - \frac{4b^6}{a^6}}}{2} - \frac{27c}{2a} + \frac{b^3}{a^3}}} \\
x &= \alpha + \beta + \frac{\beta^2}{\alpha} \\
\alpha &= -\frac{\sqrt[3]{\frac{\sqrt{\left(-\frac{27c}{a}+\frac{2b^3}{a^3}\right)^2 - \frac{4b^6}{a^6}}}{2} - \frac{27c}{2a} + \frac{b^3}{a^3}}}{3} \\
\beta &= -\frac{b}{3a}
\end{aligned}
\tag{1}
$$

$$
L_{\mathrm{d}}, H_0, L_{\mathrm{u}}, P_{\mathrm{vac}}, \sigma => a, b, c => \alpha, \beta, \frac{\beta^2}{\alpha} => x => N_{\mathrm{Ca}}
$$