

Weekly Progress Report

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1 Major Tasks

1. Reading the Research Papers (Semi Lee, Jaeki Lee, Gates).
 - Reading Prof. Gates' thesis[1] and Semi Lee's thesis for Frequency Analysis.
 - Reading the papers of Jaeki Lee[2] and Semi Lee[3].
2. FEniCS.
3. Silver Nanowire Project.
 - Integrating equations of analytic 1-D Visco-Capillary model by using Python.

2 Works Completed

1. Experiment note and KIMM ppt.
2. 4-AP experiment with KA.
3. Raman spectrum. Because the wavelength of the laser is 532 nm, it was impossible to measure the thin film.
4. XPS(X-ray photo-electron spectroscopy) and SEM-EDS(Energy-dispersive spectrometry) are recommendable.

3 Works in Progress

1. FEM Study.
2. Silver Nanowire Project.
 - Reviewing the thesis of Prof. Gates[1].
 - Utilizing the dynamic contact angle of Cox[4].
 - Confinement makes me ask definition of DCA. Therefore, I am now following up the paper of O.K. and Wonki Ahn.

DCA Measurement 1. 유량 또는 기재속도 조절

1. $R_{gt} = 2$ 일 때, $N_{Ca,B}(R_{gt} = 2)$ 를 찾는다.

정해진 H_0 에서 $h_0 = \frac{H_0}{2}$ 이므로 $Q = V_w h_0$ 로
유량과 기재속도를 정비례 관계로 실험한다.

처음으로
Bead Break-up
발생함.
 $N_{Ca,B}(R_{gt} = 2)$
일 때의
 $V_w = 8$ mpm



Q (폭 당 유량) [L/min]	V_w (기재 속도) [mpm]
10	2
20	4
40	8
80	16
100	20

$$\cos \theta_d + \cos \theta_s = 2.68 (N_{Ca,B}(2))^{2/3} = 2.68 \left(\frac{\mu V_w}{\sigma} \right)^{2/3}$$

Figure 1: DOF=1, MV=q or v

- DCA in slot coating

V_w^* is the critical velocity when the Bead Break-up firstly appears at that configuration of die lip.

θ_d^* is the critical dynamic contact angle in a confined system(slot coating station) when the Bead Break-up firstly appears at that configuration of die lip.

$$\text{at } R_{gt} = 3$$

: We can manipulate H_0 . However, this equation is a simplified form and not accurate.

$$\cos \theta_d^* + \cos \theta_s = 6 \left[\frac{L_d}{H_0} \left(1 - \frac{2}{3} \right) \right] \frac{\mu V_w^*}{\sigma} + 1.34 \cdot 3 \cdot \left(\frac{\mu V_w^*}{\sigma} \right)^{2/3}$$

$$\text{at } R_{gt} = 2$$

: We cannot manipulate anything. However, this equation is accurate because $R_{gt} = 2$ is a role of magic number in this physical system. This equation is the key of the idea of DCA in a slot coating process.

$$\cos \theta_d^* + \cos \theta_s = 1.34 \cdot 2 \cdot \left(\frac{\mu V_w^*}{\sigma} \right)^{2/3}$$

Table 1: Caption of my Table

	Sensitivity	Specificity	BACC	Threshold
Full	0.555(118)	0.924(28)	0.738(59)	0.235(29)
AIC	0.560(110)	0.927(29)	0.743(54)	0.234(30)
BIC	0.527(126)	0.924(33)	0.725(68)	0.231(31)

References

- [1] Ian D Gates. *Slot coating flows: Feasibility, quality*, volume 1. University of Minnesota, 1999.
- [2] Jaeki Lee and Jaewook Nam. A simple model for viscoplastic thin film formation for coating flows. *Journal of Non-Newtonian Fluid Mechanics*, 229:16–26, 2016.
- [3] Semi Lee and Jaewook Nam. Analysis of slot coating flow under tilted die. *AIChE Journal*, 61(5):1745–1758, 2015.
- [4] RG Cox. The dynamics of the spreading of liquids on a solid surface. part 1. viscous flow. *Journal of Fluid Mechanics*, 168:169–194, 1986.