24/03/2022

Lecture 30

Surface Tension undergoes a role reversal

1) Befor rupture it tries to Stabilize the film and opposes hole formation

2) After rupture → it now favors hole growth!

Instebilty Test on 7th April, 2022 THU

↳ 30 min / 25 marks MCQ.

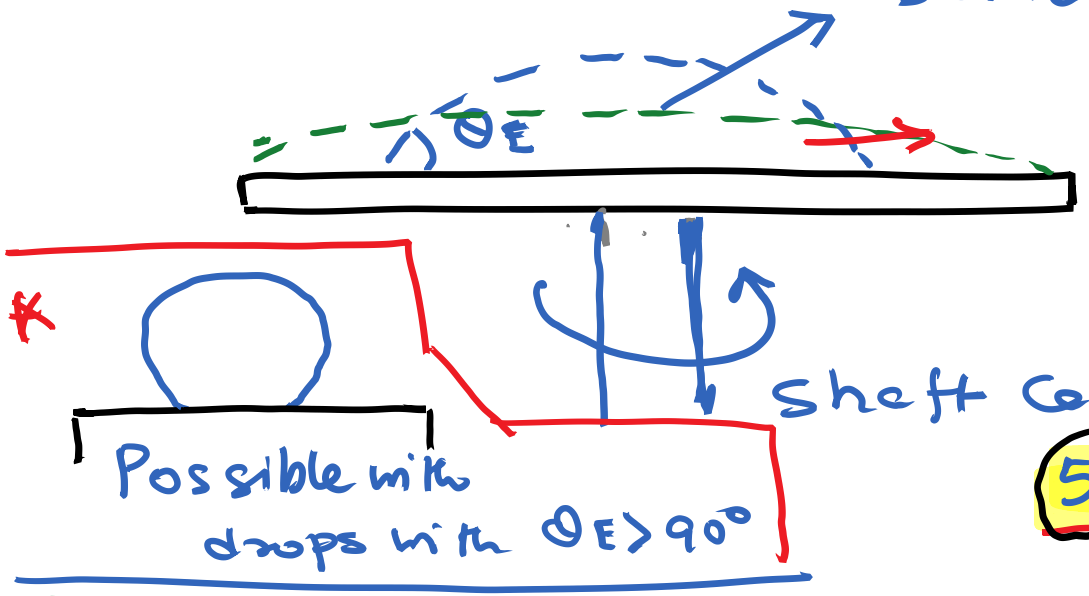
Typical Dewetting Experiments:-

(1) You need a ultra thin Liquid film.

How to create polymer thin film, which are very thin (~10 nm to 100 nm).

→ Spin Coating → Take a polymer dissolve it in a Solvent.

(It's a good Solvent + Moderately High Vap pressure).



Some amount of the Polymer Soln.

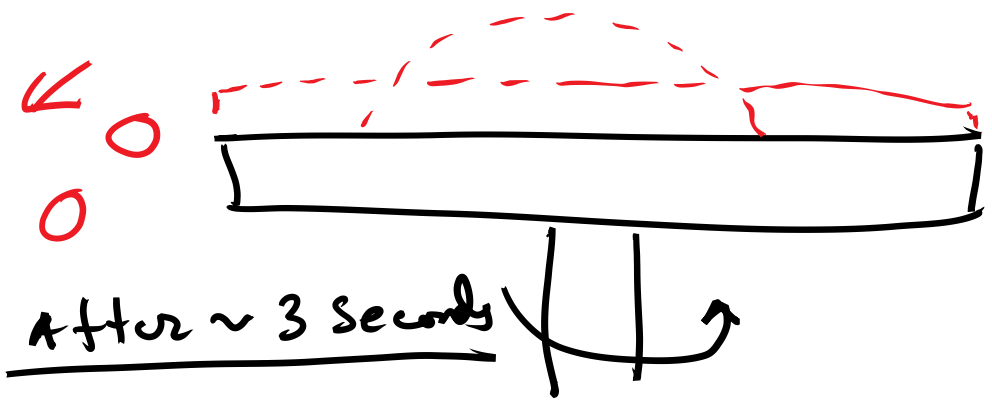
→ Substrate to be coated.

Sheft can rotate at Speeds between 500 RPM to 10,000 RPM. (*)

(1) As rotation starts, there is excess Centripetal force acting on the drop along the contact line → Drop spreads. (1-3 Seconds)

(2) The advancing meniscus → reaches the edge of Sample/ Substrate. → Major Part of the Liquid is thrown out

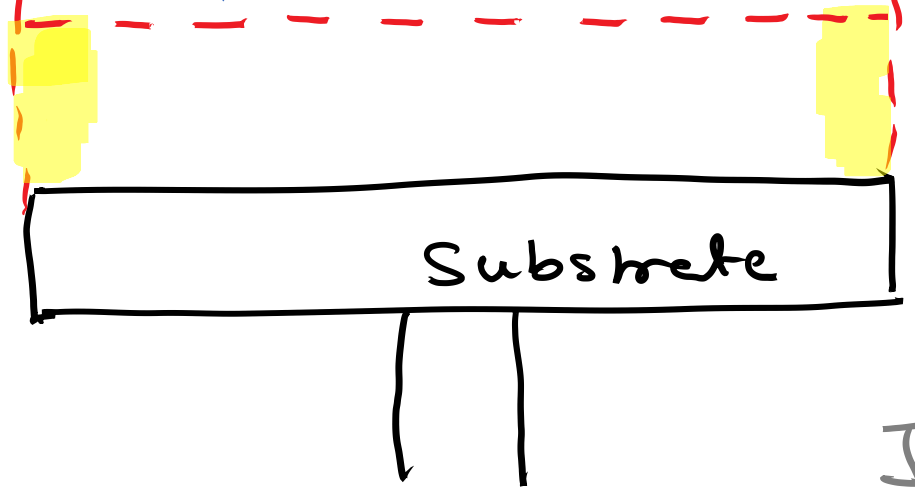
Video courtesy: Dr Nandini Bhandaru, BITS Hyderabad



Some amount of Liq is thrown away (Splashing)

95-99% Liq is splashed out

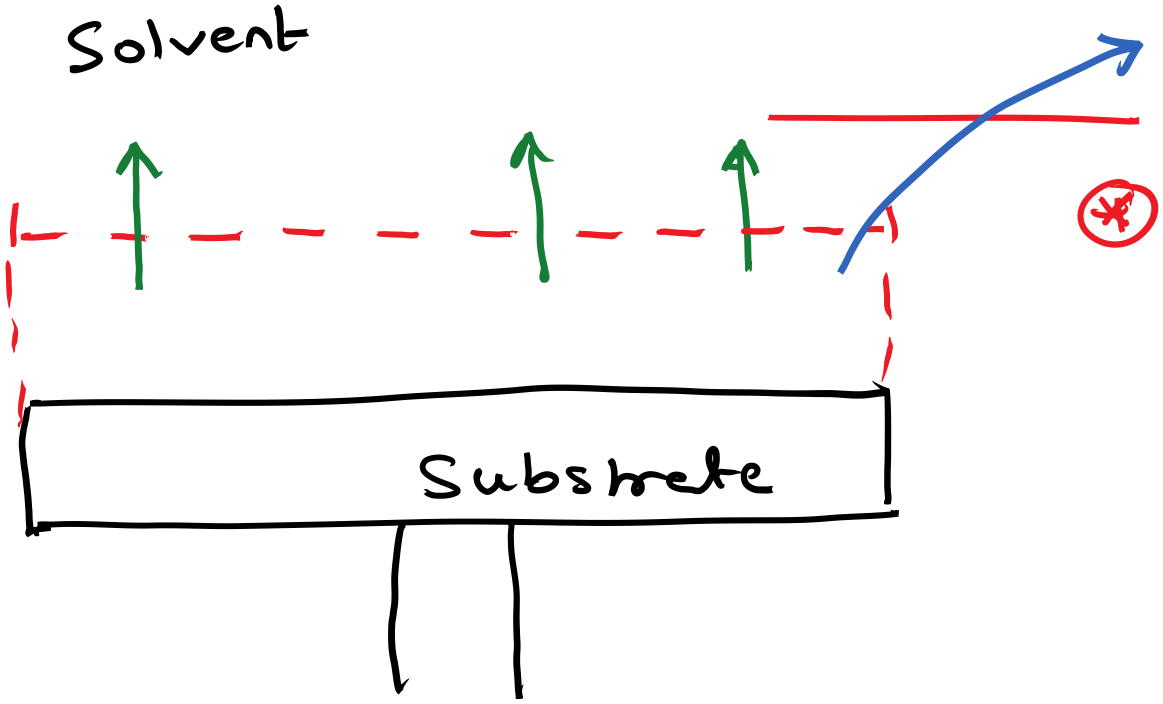
No splashing after that



* Some quasi static Pool of Liquid which is rotating over the Substrate.

It is possible to Spin Coat on a Non Wettable Surface As well.

* If Non Wettable → Apply Higher Force / Higher RPM.



⊛ Some quasi static Pool of Liquid which is rotating over the Substrate.

What is the consequence of Evaporation? → C_{ni} gradually increases.

C_{ni} → Instrinsic Concentration of Solute

(Progressive Reduction in the thk of the Solution Layer)

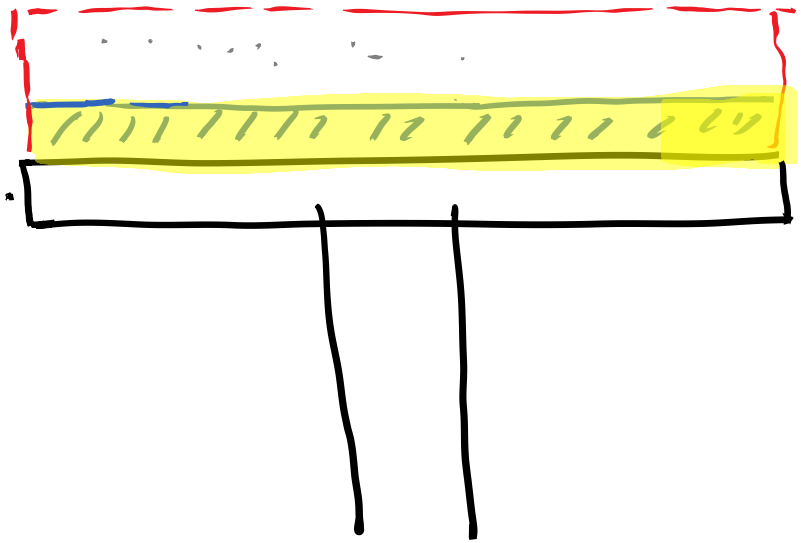
When does film deposition start?

$C_{ni} \approx C_n^*$

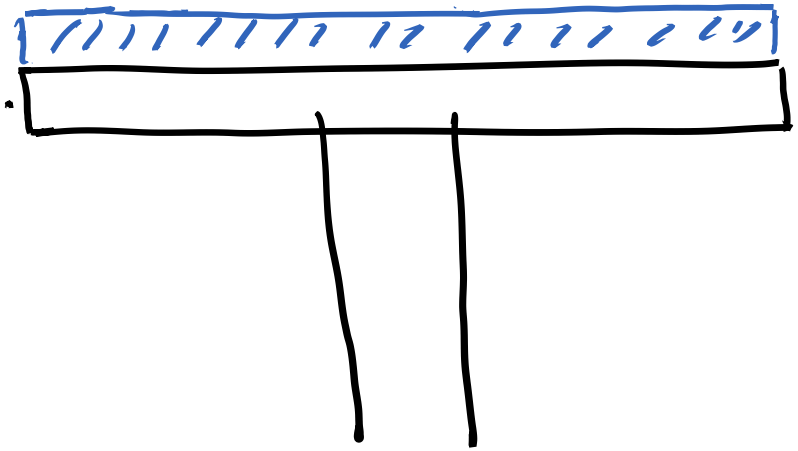
C_n^* → Saturation Concentration

↳ Solute starts to phase seperate, and deposit over the surface Forming the Film.

Film formation



* Why a low evaporating/ Low vap pr. solvent is not used !!



Later stage

Final stage

Spin Coating gives extremely uniform film thickness.

Stop Rotation

Time of Rotation → > Time Reqd

→ by the time almost all excess solvent is evaporated.