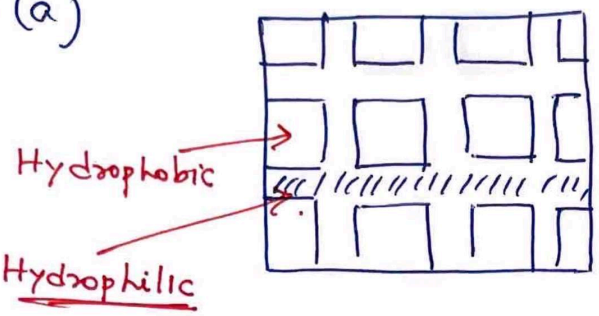
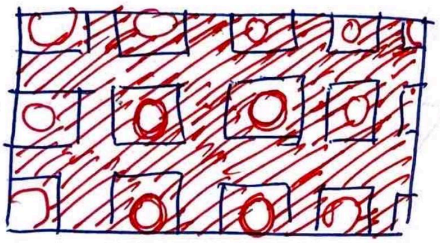
5 (a)



Annealed above glass transition temp.
So it will become liq. drop.

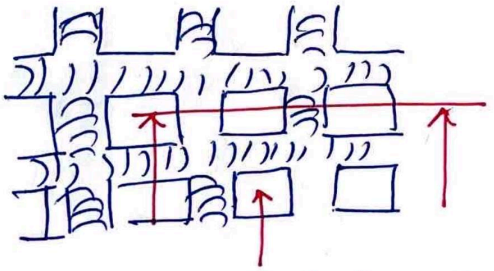
(a) Grey is hydrophilic → Wettable.
White Area is Hydrophobic → Less. Wettable.
So film is over area where the Spreading Coeff/ Sign of Hamakes constat vary Spatially.

Film is going to rupture over the Hydrophobic box domains.

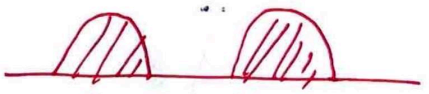


Ruptured hole. → Followed by Hole growth
→ But hole growth will limited to hydrophobic domain only

So basically we will have a ruptured film, that has ruptured and dewetted over the hydrophobic domains resulting it all polymer accumulated over the hydrophilic domains.



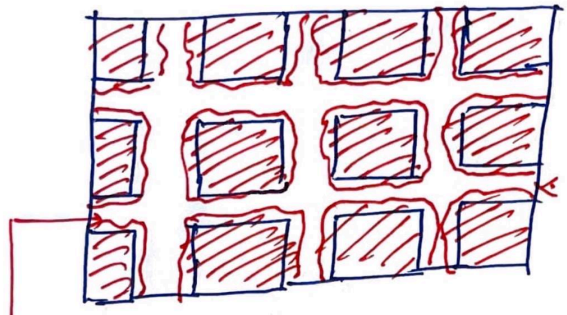
No polymer.



Cross Section of the Strips

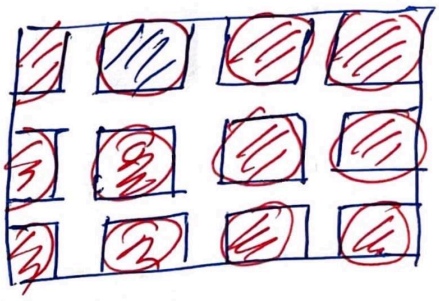
(b) Domains are swapped

So now box areas are ~~hydrophobic~~ hydrophilic and the strips are hydrophobic.

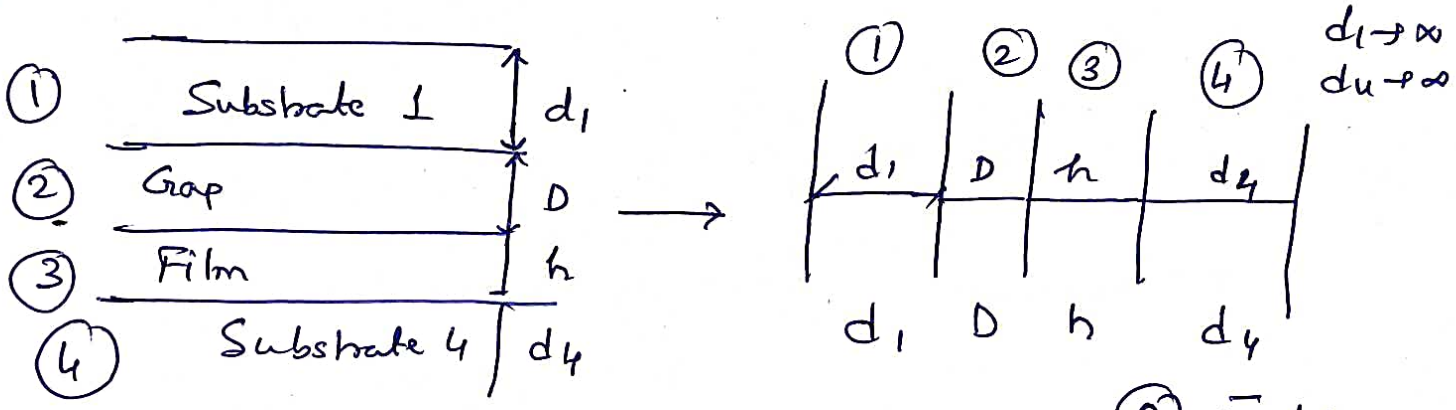


So now rupture takes over the strips

Rupture over the non wettable strips



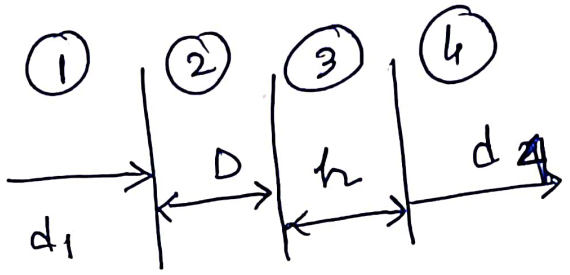
Eventually the box areas will be ~~~~ covered with polymer. The strips will be bare.



Rotate 90°

ACW

5(b) Total



2 → Air
3 → Film.

Components:

1. Self Energy of (1) $= -\frac{A_{11}}{12\pi d_1^2}$

Self Energy of Film (3) $= -\frac{A_{33}}{12\pi h^2}$,

Self Energy of (4) $= -\frac{A_{44}}{12\pi d_4^2}$

Have to Consider Interaction between (1, 3), (1, 4) and (3, 4)

Interaction between $\frac{d_1}{d_1=\infty}$ $\frac{d}{D}$. $\frac{d_2}{h}$.

(1) and (3) Film.

$$= -\frac{A_{13}}{12\pi}\left[\frac{1}{(d_1+D+h)^2} + \frac{1}{D^2} - \frac{1}{(d_1+D)^2} - \frac{1}{(h+D)^2}\right]$$

$$= -\frac{A_{13}}{12\pi}\left[\frac{1}{D^2} - \frac{1}{(h+D)^2}\right]$$

(1) and (4) $d_1 = d_1 = \infty$
$d = h+D$
$d_2 = d_4 = \infty$

$$-\frac{A_{14}}{12\pi}\left[\frac{1}{(d_1+d_2+D+h)^2} + \frac{1}{(h+D)^2} - \frac{1}{(d_1+h+D)^2} - \frac{1}{(d_4+h+D)^2}\right]$$

$$= -\frac{A_{14}}{12\pi\,(h+D)^2},$$

(3) and (4) $= -\frac{A_{34}}{12\pi}\left[\frac{1}{(h+d_4)^2} + \frac{1}{d_0^2} - \frac{1}{h^2} - \frac{1}{d_4^2}\right]$

$$= -\frac{A_{34}}{12\pi}\left[\frac{1}{d_0^2} - \frac{1}{h^2}\right]$$

G^{Lw}_{system}

$$= -\frac{A_{11}}{12\pi d_{12}} - \frac{A_{33}}{12\pi h^2} - \frac{A_{44}}{12\pi d_4^2} - \frac{A_{13}}{12\pi}\left[\frac{1}{D2} - \frac{1}{(h+D)^2}\right]$$

$$- \frac{A_{14}}{12\pi}\left[\frac{1}{(h+D)^2}\right] - \frac{A_{34}}{12\pi}\left[\frac{1}{d_o^2} - \frac{1}{h^2}\right]$$

$$= -\frac{A_{33}}{12\pi h^2} - \frac{A_{13}}{12\pi}\left[\frac{1}{D2} - \frac{1}{(h+D)^2}\right]$$

$$- \frac{A_{14}}{12\pi}\frac{1}{(h+D)^2} - \frac{A_{34}}{12\pi d_o^2} + \frac{A_{34}}{12\pi h^2}$$

$$= -\frac{(A_{33}-A_{34})}{12\pi h^2} - \frac{A_{13}}{12\pi D^2} - \frac{(A_{14}-A_{13})}{12\pi(h+D)^2} - \frac{A_{34}}{12\pi d_o^2}.$$

$$\Delta G^{Lw}_{Excess} = G^{Lw}\Big|_{D=D} - G^{Lw}\Big|_{D=\infty}$$

$$= -\frac{(A_{33}-A_{34})}{12\pi h^2} - \frac{A_{13}}{12\pi D^2} - \frac{(A_{14}-A_{13})}{12\pi(h+D)^2} - \frac{A_{34}}{12\pi d_o^2}$$

$$- \left[-\frac{(A_{33}-A_{34})}{12\pi h^2} - 0 - 0 - \frac{A_{34}}{12\pi d_o^2}\right]_{D\to\infty}$$

$$= -\frac{A_{13}}{12\pi D^2} - \frac{(A_{14}-A_{13})}{12\pi(h+D)^2} \quad (\text{Ans})$$