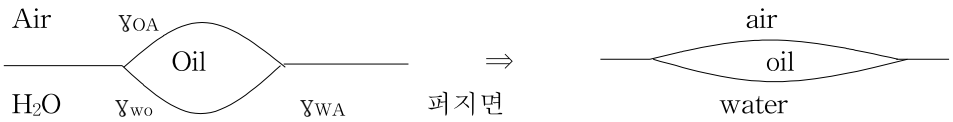
• **Spreading**



$-dA_{H2O/air}=dA_{oil/air}=dA_{oil/H2O}$

$\Delta G=(\gamma_{OA}+\gamma_{OW}-\gamma_{WA})dA$

Spreading coefficient(s)=$-\frac{\partial G}{\partial A}=\gamma_{WA}-(\gamma_{OA}+\gamma_{OW})$

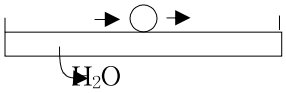
S ┌ + (= $\frac{\partial G}{\partial A}<0$) : spontaneous spreading

└ − (= $\frac{\partial G}{\partial A}>0$) : spontaneous concentration

(−가 되려면 A↑G↑해야 되는데 G↑쪽으로 진행안됨)

for Benzene on water surface

퍼지다가 다시 돌아옴(contraction)



$S_{initial}=\gamma_{WA}-(\gamma_{OA}+\gamma_{OW})=72.8-(28.9+35)=8.9$

$S_{finial}=62.4-(28.8+35)=-1.4$

ex)페인트 코팅

• Molecular film

⇒insoluble surface active material

┌ Gibbs monolayer : soluble material

└ Langmuir-Blodgett film : insoluble material

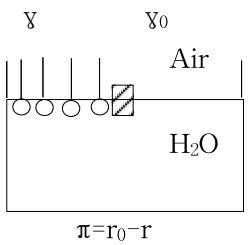
┌ salting-out : soluble물질을 bulk로부터 배척 ex)NaCl

└ salting-in : insoluble 물질을 bulk내로 이동시키는 것 ex)NH_4NO_3

• Surface pressure

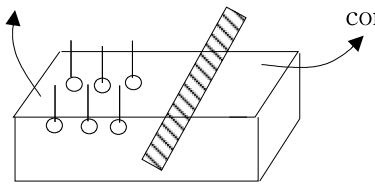
pressure : N/m^2

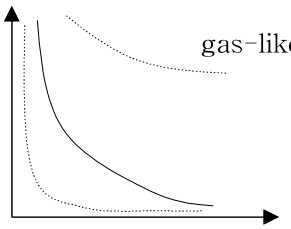
surface pressure : N/m



expand (∵energy high)

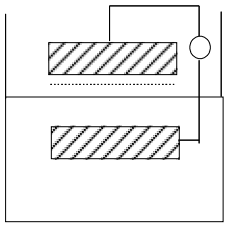
contraction

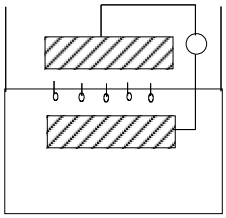




• Surface potential

air





H_2O

V_0 V_f

전극 : polonium electrode

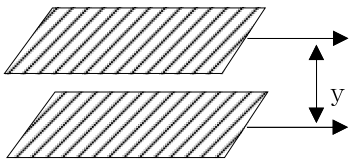
공기를 ionization

(보통 전극을 쓰면 전압이 둘 다 ∞로 나옴)

$\Delta V = V_f - V_0$

• Surface Rheology(유동학)

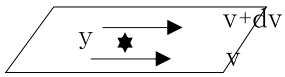
bulk viscosity : 공간내에서 서로 다른 속도로 움직이는 평면간에 작용하는 힘



$\tau = -\mu \frac{dV}{dy} (N/m^2)$

surface viscosity : 평면상에서 서로 다른 속도로 움직이는 line(or wire)간에 미치는 힘.

H_2O surface



$\tau^s = -\eta^s \frac{dV}{dy} (N/m^2)$

μ : g/cm-sec(poise) η^s : g/sec(surface poise)

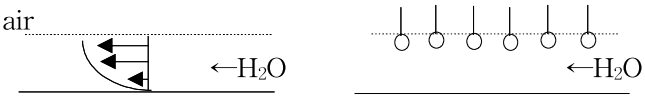
• Viscosity

shear viscosity : 분자간 거리가 일정하게 유지

dilational viscosity : 분자간 거리가 변할 경우(분자간 거리↑ 저항하는 힘)

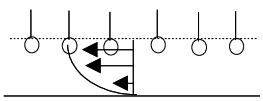
• surface viscosity 측정법

deep channel surface viscometer ⇒

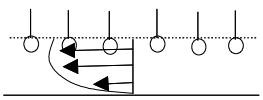


disk torsion method

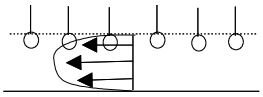
surface film의 viscosity가 0 : free water surface



middle :

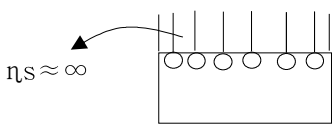


∞ :



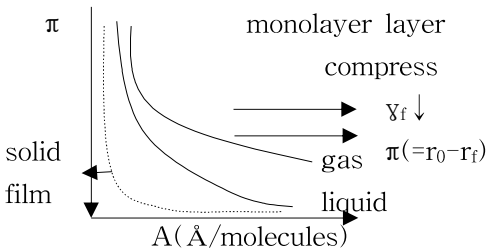
• State of monomolecular film<in bulk : Gas, Liquid, Solid>

① Solid film : closely packed, steaply oriented



② Liquid film : co-operative interaction

③ Gas film : no or small molecular interaction between molecules



④ State equation of monomolecular film

in bulk for gas : PV=nRT $(P+\frac{a}{V^2})(V-b)=RT$ van der waals eq.

(a:분자간 interaction 보정 b:분자의 부피 보정)

for liquid or solid (×)

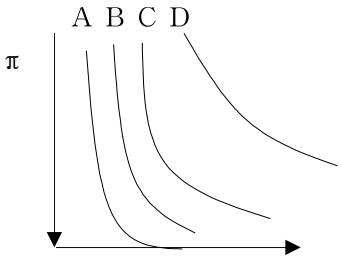
in monomolecular film(2-D)

for Gaseous state : πA=kT

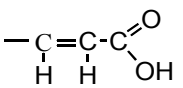
(π:surface pressure, A:한분자가 차지하는 면적, k:Boltzman constant)

for van der waals eq. : $(\pi-\pi_0)(A-A_0)=kT$

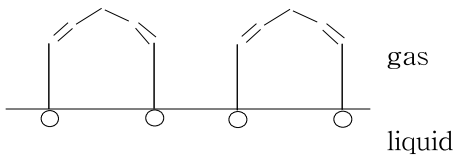
• Factor influencing the physical state of monomolecular film



:

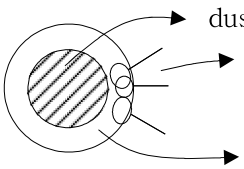


(unsaturated cis hydrophobic chain)



A: ~~~ OH(straight chain, small hydrophilic group)

B: ~~~C(=O)OH (straight chain, large hydrophilic group)



dust : D를 쓰면 별 효과없다

계면활성제

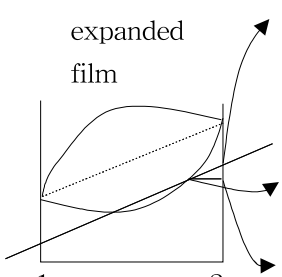
air : A가 효과좋다

water

• Mixed monomolecular film

i) ideal mixed monolayer

: follow additivity rule



partial area/molecule of component 2 when the mixing ratio = 0.3 : 0.7

조성

1:0.3

2:0.7

mixedmonolayer의 area/molecule

(if A) physical property

partial area/molecule of component 1 when the mixing ratio = 0.3 : 0.7

ii) expansion of mixed monolayer
iii) compressed mixed monolayer