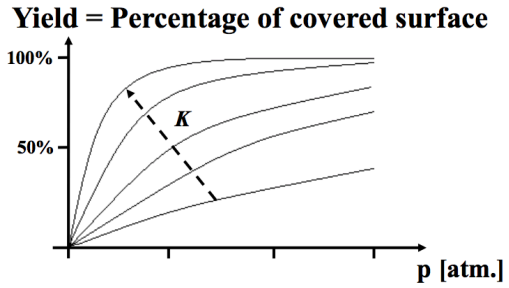
Langmuir Model

Adsorption of gas molecules on the surface

YIELD vs PARTIAL PRESSURE

$$Y_{yeld} = \frac{[A]}{[BS]} = \frac{K_{eq}p}{1 + K_{eq}p}$$

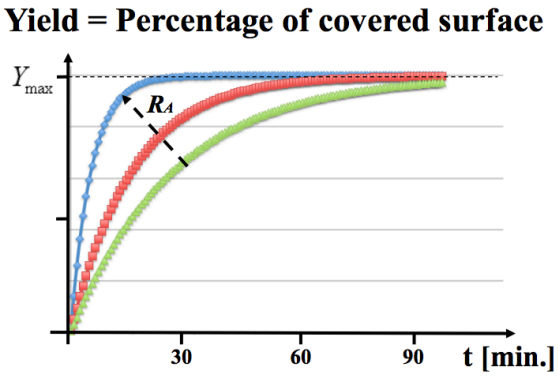
L = gas molecule
BS = binding sites
Keq = equilibrium constant
p = adsorbate partial pressure



YIELD vs TIME

$$Y(t) = 1 - e^{-R_A t}$$

R_A= adsorption rate



Kisliuk Model

Improvement to Langmuir model to account for the precursor state: some molecules are initially adsorbed on the surface providing a sticking layer for further adsorption.

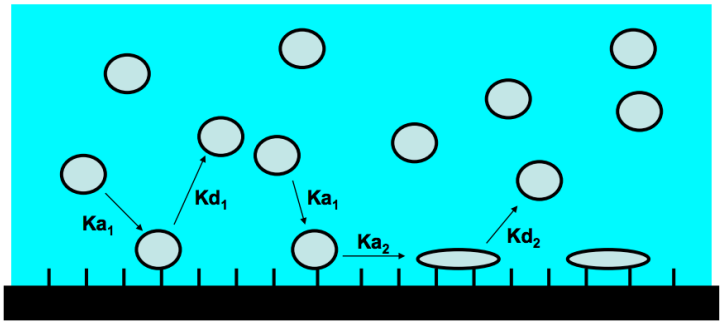
YIELD vs TIME

$$Y(t) = \frac{1 - e^{-R_A(1+k_S)t}}{1 + k_S e^{-R_A(1+k_S)t}}$$

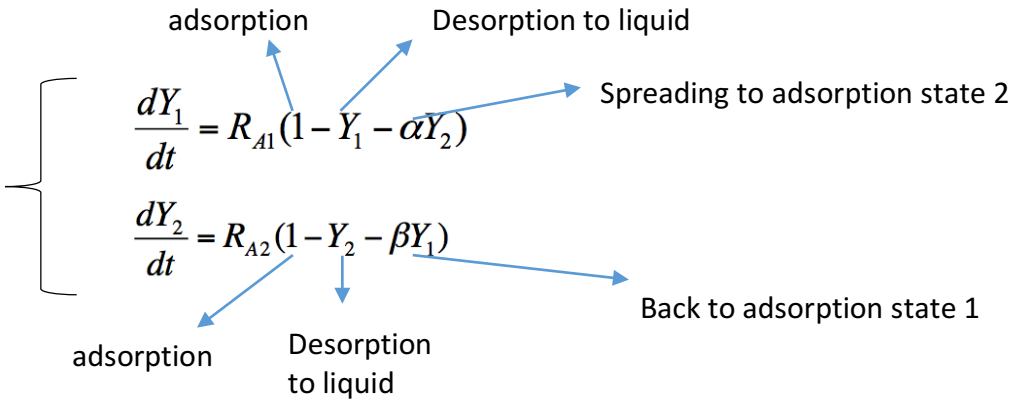
k_s = sticking coefficient

Spreading model

After the adsorption on the surface (adsorption state 1), the molecule can spread over multiple binding sites to improve its anchoring (adsorption state 2).



YIELD vs TIME



At equilibrium we can put these 2 equations =0 and solve the system to get the Yield versus time:

$$Y_2 = \frac{1-\beta}{1-\alpha\beta}$$
$$Y_1 = 1 - \alpha Y_2$$