Introduction

Background: Anthropogenic CO_2 emission

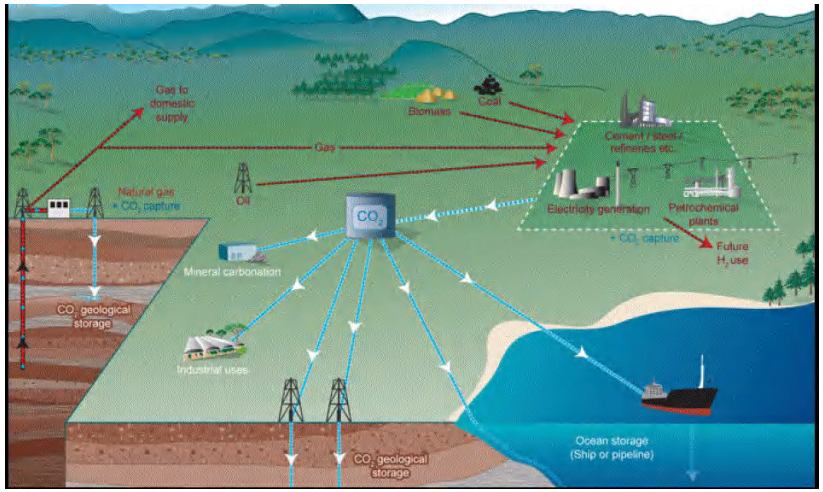
- Industrialize
- Vast amount of using fossil fuels
- Emission of greenhouse gases
- Global warming

Carbon Zero Emission

CO2 GLOBAL

Solutions: Carbon capture and storage (CCS)

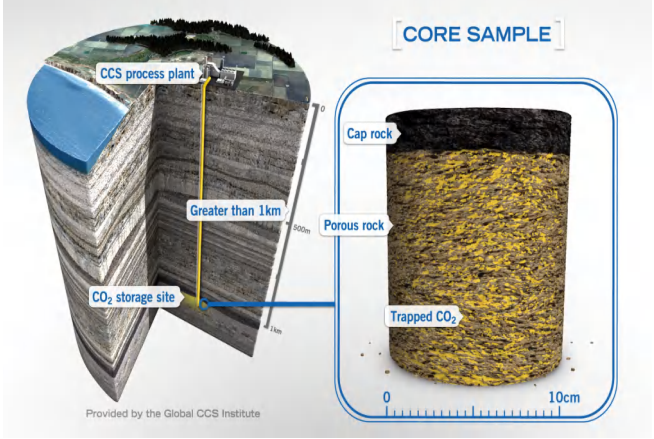
- CO_2 geological storage √
  - Saline aquifer storage √
  - Offshore storage
  - Depleted oil reservoir storage (CO_2-EOR)
- Terrestrial ecosystem storage
- Mineral carbonation storage



IPCC, 2005

CO_2 geological storage: trapping mechanism

- Structure trapping (or hydrodynamic trapping)
  - Mineral dissolution or precipitation of caprock
- Capillary trapping (or residual trapping)
  - The capillary entry pressure *pc* estimated by the standard Young–Laplace equation
  - fluid–fluid and fluid–solid interactions such as interfacial tension *γ* and contact angles *θ*



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$$P_C^{\text{th}} = P_{CO2} - P_{\text{water/brine}} = \frac{2\gamma_{w/b,CO2}\cos\theta}{R}$$

Thus, proper estimation of the interfacial tension (IFT) and wettability between the reservoir fluids, rocks and CO_2 has a significant influence on estimating the carbon storage capacity and efficiency of the reservoir

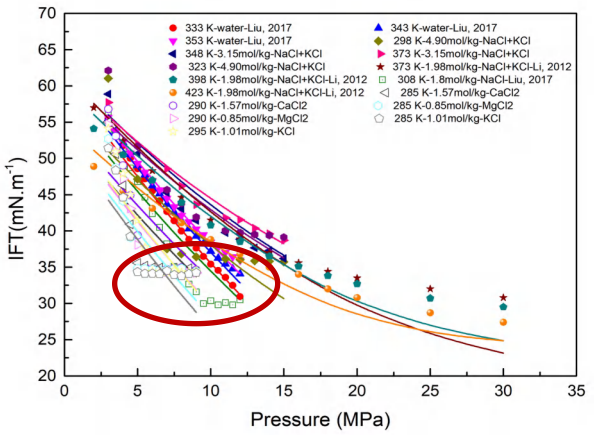
The empirical interfacial tension model

The empirical interfacial tension (IFT) model for CO_2-water/brine binary system was established based on the linear relations between IFT and molality.

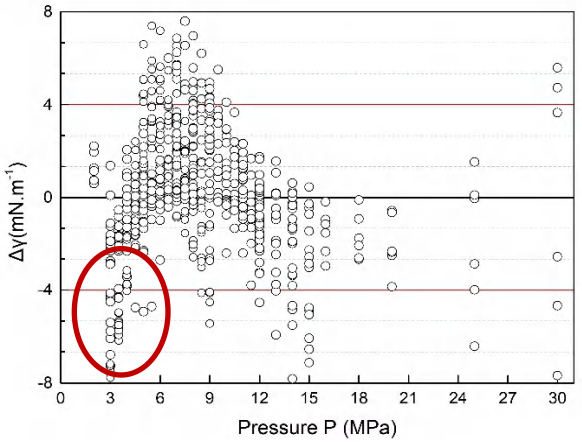
$$\gamma = A[m^+] + B \qquad m^+ = \sum_{i=1}^{n} z_i m_i$$

$$A = a_0 + a_1 P_r + a_2 T_r$$

$$B = b_0 + b_1 P_r + b_2 T_r + b_3 P_r^2 + b_4 P_r T_r + b_5 T_r^2$$



Distribution of the CO_2-brine IFT via experiment and estimation



Deviation of the CO_2-brine IFT between experiment and estimation

Parameters	a_0	a_1	a_2	b_0	b_1	b_2	b_3	b_4	b_5
Values	3.672	1.376	-3.232	-165.524	-3.663	382.276	1.760	13.217	-160.054

- Deviation of the CO2-brine IFT between experiment and estimation $\Delta\gamma$ was about **±4 mN•m^{-1}**, however larger deviations were found when isotherms reached a plateau.
- This method can be used to predict the IFT for CO_2-water/brine binary system under CO_2 geological storage conditions using only few regression coefficients with a relatively low error (285≤T≤423 K，0.1 ≤ p ≤ 30 Mpa，0≤ m ≤ 4.9 mol·kg^{-1}).