Note Title 3/12/2018

EOR - Gas Immiscible & Miscible Processes

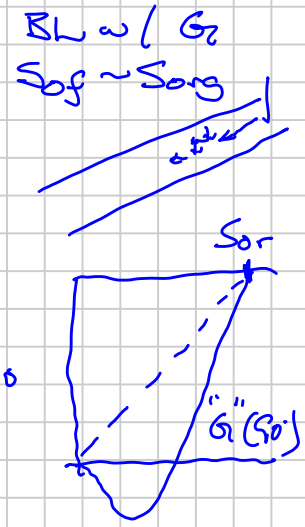
$k_m \gtrsim 0.01$ md — Conventional Single-Porosity (not NF) *
& — " — Dual-Porosity (w/ NF)
& Unconventional Single & Dual Porosity
$k_m \lesssim 0.01$ md (w/ or w/out NF | always
→ 10 nd Artificial / Induce F-M system)

① CONFORMANCE (Areal & Vertical Macroscopic Sweep Efficiency)

- Defined as HCPV contacted by gas
- $k(x,y,z)$ heterogeneity : $k=0$ barriers
- Gravity

② Microscopic Recovery Processes (Pore-level)

- Immiscible ("BL") : no VLE



S_{of} + S_{org} ↓ 0

- ⇒ Immiscible — VLE w/ BL (EOS!) — $K_i : i = C_{6+}$ — $S_{of} = S_{org} \to 0$
- Miscible

>90% • C/V Process (Zick)
Condensing / Vaporizing (C_2-C_6)

<10% • VGD (Leaning Gas: C_1, N_2)
Vaporizing Gas Drive

• Particularly useful if "high" S_{oi} after WF or bad rel.perm w/ little gravity

Fractured Systems

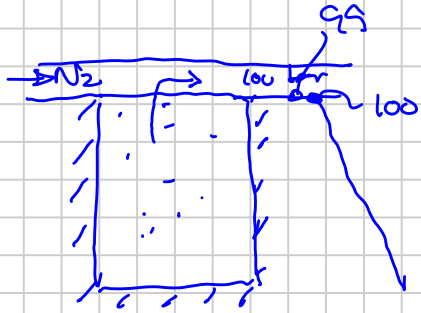
- Gravity – Capillary Equilibrium
  w/out VLE or VLE (non-equilibrium phases)
  $P_{cgo}(\sigma_{go})$ $\quad x_i \rightarrow y_i \quad \sigma_{go}$ (optional)

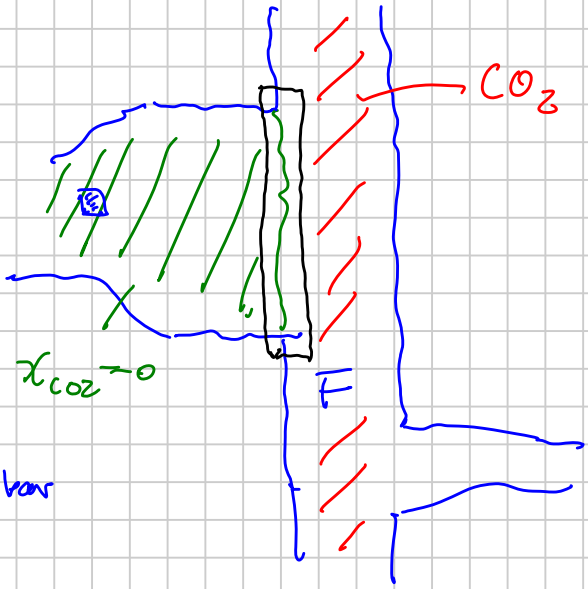
- VLE : Swelling
- VLE : Vaporization
- IFT : $(P_{cgo} \propto \sigma_{go})$ | $\underbrace{\underbrace{k_{ro}(S_o)}_{f(\sigma_{go})} \; S_{org}}_{3L}$
- Diffusion :
  - Gas Phase (fill fractures)
  - Oil Phase (fills all/part of matrix)

$\sigma(\rho_o - \rho_g)$

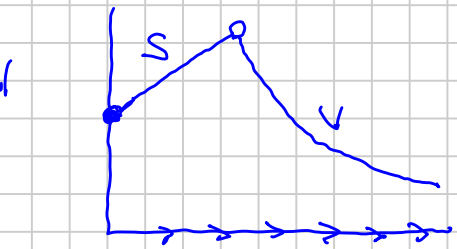
$\sigma_{go} P_{cgo} = P_g - P_o$

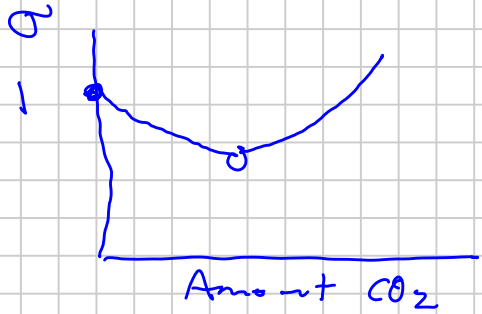
oil bar
1 bar





@ P = 5000 psia





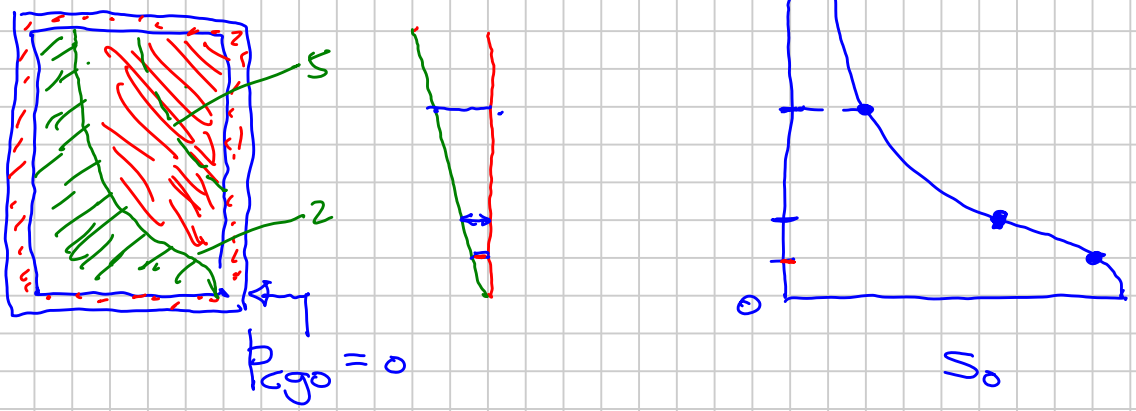
$\sigma_{go} \propto (\rho_o - \rho_g)$

- Imbibition | Re-imbibition

$$\sum_{\text{matrix blocks}} (RF)_{\text{matrix block}}(t) = RF_{\text{field well}}$$

no-VME Gas-Oil Gravity-Capillary

$P_{cgo} \propto \sigma_{go}$



Drainage

Saidi : Haft Kel

$\sigma_{go}(P) = 2 \rightarrow 5$ mN/m

Gas Inj (3.5)

$\nabla = 3.5$ $\sigma_{ref} = 70$

S_g P_{cgo} k_{rg} k_{rog}

Measure P_{cgo} (air-water) $\sigma_{aw} = 70$ mN/m

$\sigma_{go;} = 2$ mN/m

$$P_{cgo;} = P_{caw} \cdot \left(\frac{\sigma_{go;}}{\sigma_{aw}} \right)$$