Note Title 3/1/2018

PVT Laboratory Tests (Ch. 6)

Conventional (Ch. 6)

(*) - Depletion and Water Flooding Processes

Gas-Based EOR (Ch. 8)

① What is Measured? ✓

② Why is measured? ✓

③ How is measured?

④ How is it reported?

⑤ How do we use it?

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① What is Measured?

- Engineering Fluid Properties
  - * • Density
  - * • Viscosity
  - ⊙ Composition ⇒ Products (R_p r_p)
  - • PE Volume Ratios (B_o B_g R_s r_s)
  - • Compressibility
  - * • Phase Amounts
    - Expansion
    - Shrinkage

$$v = \frac{k}{\mu} \frac{\Delta p}{\Delta x}$$

$$v_p = \frac{k_p}{\mu_p} \frac{\Delta p_p}{\Delta x}$$

$$k_p = k \cdot k_{rp}$$

$$n_p \sim 2.-5$$

$$k_{rp} \propto S_p^{n_p}$$

Purpose of Petroleum Companies

- Maximize Profit
  - Maximize Revenues
  - Minimize Costs

Volumetric Rate → $\dot{V}_I^{(Zw)_o}$; Price → P_p (politics, wars); $\dot{V}_I$ and P_p ← product

$$\text{Revenues} = \dot{V}_I^{(Zw)_o} \, P_p$$

Price:

Henry Hub — USA:
USD $65.72 / STB
$ 3 / Mscf

£ 0.6 / therm
60 p / therm

0.01 Therm = (10^3 Btu)

10 Therm / 10^3 scf
10 Therm / Mscf

600 p / Mscf
£ 6 / Mscf
$ 8 / Mscf

Costs:

- Well Cost × N_{wells} ↑
- Pipelines ↑
- Platforms ↑ (FPSO)

} $f(\Delta p)$

- friction: μ, % L
- gravity: ρ, % V

PVT Lab Measurements

① Sample(s) (all reservoir fluids)

- Wellstream sample @ surface "Separator Samples"

Res. Oil (only) cw - Bottomhole sample @/near producing interval with a wireline sampler immersed in fluids near the wellbore

All reservoir fluids $k \gtrsim 0.01$ md 0.1 - Formation "Spot" Sample @ particular depth before well is cased, directly connected to reservoir rock

local, "spot" (1"-diameter area) production test

1970s: RFT (SLB)

1980s: MDT (SLB)

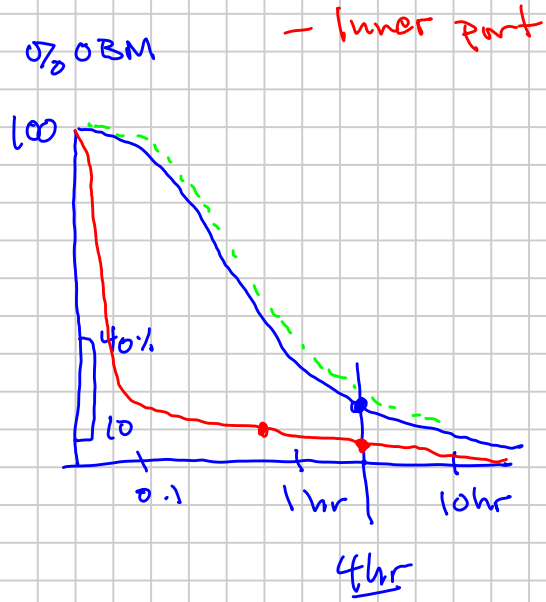
RCI

2000s: MDT* } Dual-Pump tools (OBM)

RCI* }

"Openhole Formation Tester" (MDT)

Focused MDT



- Inner part/pump