Undersaturated Oil Compressibility and Bo Above the Bubble Point

Isothermal compressibility of oil above the bubble point and the shrinking oil formation volume factor by Vasquez–Beggs and Petrosky–Farshad.

Input parameters

Unit system: SI

Parameter	Value	Unit
Pressure (above the bubble point)	6,000.0	psi
Bubble-point pressure	3,200.0	psi
Oil formation volume factor at the bubble point	1.2100	
Solution GOR at the bubble point	350.00	scf/STB
Gas gravity (air = 1)	0.75000	
Oil gravity	25.000	
Temperature	160.00	°F
Separator pressure (for Vasquez–Beggs)	114.70	psi
Separator temperature	80.000	°F

Calculated results

Parameter	Value	Unit
Oil compressibility (Vasquez–Beggs)	4.1654e-06	1/psi
Oil compressibility (Petrosky–Farshad)	4.8067e-06	1/psi
B_o at the pressure (Vasquez–Beggs)	1.1911	
B_o at the pressure (Petrosky–Farshad)	1.1908	
Gas gravity at 100 psig separator	0.75000	

Notes for this case

• B_o above the bubble point integrates c_o from p_b: oil is compressed and B_o falls slowly with pressure. The comparison: Vasquez–Beggs 6.2 %, Petrosky–Farshad 4.1 % average error on c_o.

Formula and method

$$c_o = \frac{-1433 + 5R_{sb} + 17.2T - 1180\gamma_{gs} + 12.61API}{10^5 p}, \quad B_o = B_{ob}\exp\left[-A\ln\frac{p}{p_b}\right], \quad B_o = B_{ob}\exp\left[A_{PF}(p_b^{0.4094} - p^{0.4094})\right]$$

Variables

p	Pressure (above the bubble point)	Pa
p_b	Bubble-point pressure	Pa
B_{ob}	Oil formation volume factor at the bubble point	-
R_{sb}	Solution GOR at the bubble point	m³/m³
γ_g	Gas gravity (air = 1)	-
API	Oil gravity	-
T	Temperature	K
p_{sep}	Separator pressure (for Vasquez–Beggs)	Pa
T_{sep}	Separator temperature	K
$c_{o,VB}$	Oil compressibility (Vasquez–Beggs)	1/Pa

$c_{o,PF}$	Oil compressibility (Petrosky–Farshad)	1/Pa
$B_{o,VB}$	B_o at the pressure (Vasquez–Beggs)	-
$B_{o,PF}$	B_o at the pressure (Petrosky–Farshad)	-
γ_{gs}	Gas gravity at 100 psig separator	-

Method and standards

Vasquez–Beggs and Petrosky–Farshad (psia, °F).

Assumptions and limits

- Undersaturated black oil.

Report details

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