— University of Mosul —
College of Petroleum & Mining Engineering

Petrophysical properties of rocks

Lecture fourth

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LECTURE CONTENTS

Calculating Original Oil and Gas in Place by the Volumetric Method

To better understand reserves estimation, a few important terms require definition. Original oil in place (OOIP) and original gas in place (OGIP) refer to the total volume of hydrocarbon stored in a reservoir prior to production. Reserves or recoverable reserves are the volume of hydrocarbons that can be profitably extracted from a reservoir using existing technology. Resources are reserves plus all other hydrocarbons that may eventually become producible; this includes known oil and gas deposits present that cannot be technologically or economically recovered (OOIP and OGIP) as well as other undiscovered potential reserves.

Estimating hydrocarbon reserves is a complex process that involves integrating geological and engineering data. Depending on the amount and quality of data available, one or more of the following methods may be used to estimate reserves:

A. Volumetric: OOIP, OGIP, recoverable reserves. Use early in life of field.

B. Material balance: OOIP, OGIP, assumes adequate production history available, recoverable reserves (assumes OOIP and OGIP known). Use in a mature field with abundant geological, petrophysical, and engineering data.

C. Production history: Recoverable reserves. Use after a moderate amount of production data is available.

Analogy: OOIP, OGIP, recoverable reserves. Use early in exploration and initial field development

1. Calculating Original Oil in Place(OOIP) by the Volumetric Method

One important application of the effective porosity is its use in determining the original hydrocarbon volume in place. Consider a reservoir with an areal extent of **A** acres and an average thickness of **h** feet.

Bulk volume = 43,560 Ah, ft^3

Bulk volume = 7,758 Ah, bbl

PV = 43,560 AhØ, ft^3

PV = 7,758 AhØ, bbl

$$OOIP\ (N \text{ or } N_i) = PV^* (1-S_{wi}) / B_{oi} \quad \text{---------- (19)}$$

$$OOIP\ (N \text{ or } N_i) = 7{,}758^* Ah\Phi(1-S_{wi}) / B_{oi} \quad \text{---------- (20)}$$

$$OOIP\ (N \text{ or } N_i) = 7{,}758^* Ah\Phi^*(S_o) / B_{oi}$$

1. Calculating Original Gas in Place (OGIP) by the Volumetric Method

$$V_b = 43{,}560 * A * h$$

$$OGIP\ (G\ or G_i) = V_b * \Phi * (1-S_{wi})/B_{gi} \quad \text{---------- (22)}$$

$$OGIP\ (G\ or G_i) = 43{,}560 * A * h * \Phi * (1-S_{wi}) \quad \text{in } ft^3 \quad \text{---------- (23)}$$

$$OGIP\ (G\ or G_i) = 43{,}560 * A * h * \Phi * (1-S_{wi}) / B_{gi} \quad \text{in MMSCF}$$