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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 28912-2025

Replacing GB/T 28912-2012

Test method for two phase relative permeability in rock

岩石中两相流体相对渗透率测定方法

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents". Drafting.

This document supersedes GB/T 28912-2012 "Method for Determination of Relative Permeability of Two-Phase Fluids in Rocks" and is consistent with GB/T 28912-2012.

Aside from structural adjustments and editorial changes, the main technical changes are as follows.

a) The determination of bound water saturation using nuclear magnetic resonance (NMR) in the steady-state and unsteady-state oil-water relative permeability measurements was enhanced using fresh, loose rock samples.

The non-magnetic encapsulation method (see 4.1.3.1.4);

b) Added the use of fresh rock samples for determining bound water saturation using nuclear magnetic resonance (NMR) in the steady-state and unsteady-state oil-water relative permeability measurement process.

The preparation method for the test water is described in section 4.1.3.5.2.

c) An experimental procedure for determining the water saturation of steady-state oil-water relative permeability using the CT method has been added (see 4.1.4.3.2);

d) An experimental method for determining bound water saturation by nuclear magnetic resonance (NMR) during steady-state and unsteady-state oil-water relative permeability measurements has been added (see...). 4.1.4.3.5);

e) A method for calculating the water saturation of steady-state oil-water relative permeability using the CT method has been added (see 4.1.5.3);

f) Added a method for calculating bound water saturation using NMR spectroscopy during steady-state and unsteady-state oil-water relative permeability measurements (see...). 4.1.5.4).

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed and is under the jurisdiction of the National Technical Committee on Standardization of Petroleum and Natural Gas (SAC/TC355).

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The release history of this document and the document it replaces is as follows.

- First published in 2012 as GB/T 28912-2012;

- This is the first revision.

1 Scope

This document describes the basic principles of steady-state and unsteady-state methods for determining the relative permeability of two-phase fluids in rocks, and specifies the determination procedures.

Technical requirements, calculation methods, and technical specifications of measuring instruments.

This document applies to the determination of the relative permeability of two-phase fluids in sandstone samples; other types of porous media should refer to this document for further details.

The steady-state method is suitable for determining the relative oil-water permeability of rock samples with air permeability greater than 50 mD and rock samples with air permeability greater than 0.5 mD.

Measurement of water-air relative permeability.

The unsteady-state method is applicable to the determination of oil-water relative permeability in rock samples with air permeability greater than 5 mD and rock samples with air permeability greater than 1 mD.

The gas-liquid relative permeability was measured.

For other rock samples outside the aforementioned permeability range, the same procedure applies.

2 Normative references

GB/T 29172

3 Terms and Definitions

This document does not contain any terms or definitions that need to be defined.

4.1.1 Principle

The basic theoretical basis for determining the relative permeability of oil and water using the steady-state method is the one-dimensional Darcy flow theory, which assumes that the two fluid phases are immiscible and incompressible.

The pressure was reduced, and the effects of capillary pressure and gravity were ignored. During the experiment, with a constant total flow rate, oil and water were simultaneously injected at a constant rate in a certain flow ratio.

Rock sample is introduced. When the inlet and outlet pressures and oil and water flow rates are stable, the water saturation of the rock sample no longer changes. At this point, the oil and water content within the pores of the rock sample...

The distribution is uniform, reaching a stable state, and the effective permeability values of oil and water are constant. Therefore, by measuring the inlet and outlet pressures of the rock sample and the oil, Water flow rate, the effective permeability and relative permeability of the rock sample are directly calculated using Darcy's law. This can be achieved using methods such as gravimetric analysis, mass balance, or other methods.

Computer tomography (CT) was used to calculate the corresponding average water saturation of the rock sample. By changing the oil-water injection flow rate ratio, a series of results could be obtained.

The relative permeability values of oil and water at different water saturation levels were determined, and the oil-water relative permeability curves of the rock samples were plotted accordingly.