ICS 71.040.40
CCS G 04

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 18295-2026

Replacing GB/T 18295-2001

Microbeam analysis - Scanning electron microscope analysis of sandstone samples from oil and gas reservoirs

微束分析 油气储层砂岩样品扫描电镜分析方法

Issued on: February 27, 2026 **Implemented on: September 1, 2026**

Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC

Table of Contents

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 18295-2001 "Scanning Electron Microscopy Analysis Methods for Sandstone Samples from Oil and Gas Reservoirs" and is consistent with GB/T 18295-Compared to.2001, aside from structural adjustments and editorial changes, the main technical changes are as follows:

a) The scope has been changed, and "instruments, software and materials, sample preparation, test procedures, analytical procedures and fractionation" has been added to the description. The analysis report has been expanded to include "sandy components in rocks such as mudstone, shale, and coal" in its applicable content (see Chapter 1,.2001 edition). Chapter 1);

b) The term "skeleton" has been removed (see

3.10 of the.2001 edition);

c) The terms "face rate," "secondary enlargement," "leaching," and "replacement" have been changed (see 3.6-3.9, 3.2, 3.7, and

3.8 in the.2001 edition). 3.9);

d) The principle has been added (see Chapter 4);

e) Software has been added (see Chapter 5);

f) Changes were made to the instruments, materials, and reagents (see Chapter 5, Chapter 4 of the.2001 edition);

g) Sample preparation has been modified (see Chapter 6, Chapter 5 in the.2001 edition);

h) The experimental procedures were changed (see Chapter 7, Chapter 6 of the.2001 edition);

i) Added analytical steps, including porosity and throat analysis, and mineral analysis (see Chapter 8);

j) The methods for measuring pore size and throat size, calculating porosity, and analyzing minerals were revised (see Chapter 8,.2001 edition). Chapter 6);

1 Scope

GB/T 18295-2026 is the Chinese national standard covering looking at reservoir sandstone in the electron microscope - the pore structure and its connectivity, the clay minerals lining the pores that swell and block them, and the cement that decides whether the rock will produce. It replaces GB/T 18295-2001 and has been in force since 1 September 2026. It was issued on 27 February 2026 and has been in force since 1 September 2026, replacing GB/T 18295-2001. The document is under the responsibility of the Standardization Administration of China. This page is published from the official record of the 2026 edition; the clause text of a standard this recent is not yet in circulation, and the figures, limits and tables it contains are those of the document itself, delivered in full with the English translation.

This document describes the principles, instruments, software, materials, sample preparation, and experimental procedures used in scanning electron microscopy (SEM) analysis of sandstone samples from oil and gas reservoirs. The analysis process includes steps and reports. This document applies to scanning electron microscopy (SEM) analysis of sandstone samples, and also to the SEM analysis of sandy components in mudstone, shale, coal, and other rocks. analyze.

4.Principles This paper uses scanning electron microscopy to characterize sandstone samples with natural fracture surfaces and those polished by argon ion beam, obtaining information on minerals such as cementation. Information such as reservoir type, pore and throat characteristics, overall porosity, and overall mineral composition enables qualitative evaluation of the reservoir. To observe the natural morphological characteristics of minerals in sandstone samples, it is necessary to prepare natural cross-section specimens. During

sample preparation, liquid contamination and mineral contamination should be avoided as much as possible. Damage such as particle detachment was identified, followed by electron microscopy and energy dispersive spectroscopy analysis, and the determination and occurrence description of mineral types such as cement were completed. To observe the pore and throat characteristics in sandstone samples, argon ion beam polished samples need to be prepared to expose those obscured by detrital minerals, matrix, etc. The real pore-throat network was then imaged and analyzed using electron microscopy, and the pore and throat types were determined, along with the pore and throat scales. Measurement of inches. To obtain the overall porosity of the sandstone sample, a large-area mosaic image of the argon ion beam polished sample is required, and the image grayscale values are then used for analysis. The pores are divided by phase segmentation, and the porosity is calculated. To obtain the overall mineral composition of sandstone samples, backscattered electron (BSE) imaging and energy dispersive spectroscopy are required for argon ion beam polishing of the samples. Scanning analysis, utilizing atomic number contrast and elemental data at each test point, identifies mineral phases based on a standard mineral characteristic database, and obtains overall... Mineral composition.

5 Instruments, equipment, software and materials

5.1 Instruments and Equipment The main equipment includes.

a) Scanning electron microscope (secondary electron image resolution should be better than 2nm, backscattered electron image resolution should be better than 5nm);

b) Energy dispersive spectrometer (crystal effective area should be greater than 20 mm2, elemental analysis range Be 4~U 92);

c) Vacuum coating machine or ion sputtering machine (preferably with film thickness measurement capability);

d) Argon ion beam polishing machine (polishing area should be greater than or equal to 1 cm2, vacuum degree less than or equal to 5 x 10-

f) Crusher or impact hammer;

g) Cutting machine;

h) Polishing and grinding machine;

i) Ultrasonic cleaner;

j) Residual oil removal device.

5.2 Software

5.2.1 Image Analysis Software It should have functions such as binarization of scanning electron microscope images, extraction of pore structure, and quantitative calculation.

5.2.2 Automated Mineral Analysis Software It should have the following main functions.

a) Control the focused electron beam to scan the sample surface point by point, and control the image acquisition system and the energy dispersive spectrometer system to synchronously acquire backscattered electron images. Image and element data;

b) Based on the atomic number contrast and elemental data obtained at each test point, automatically identify minerals by referring to a standard mineral crystal classification database. phase of matter;

c) Analyze and obtain information such as mineral composition, grain morphology parameters, embedding characteristics and degree of liberation.

5.3 Materials The main materials include.

a) Dichloromethane (analytical grade);

b) Anhydrous ethanol (analytical grade);

c) High-purity nitrogen (purity not less than 99.99%);

d) Conductive adhesive or double-sided conductive tape, etc.;

e) Latex or epoxy resin AB glue, etc.;

f) Ear syringe or compressed air canister;

g) Diamond suspension (coarse particle size 20μm~60μm, medium particle size 3μm~15μm, fine particle size 1μm~ 1.5μm);

h) Carbon rope, carbon rod or gold target (purity not less than 99.99%).

6 Sample Preparation

6.1 Remove residual oil For oil-bearing rock samples, a residual oil removal device should be used, employing a solid-liquid extraction method to remove residual oil. Dichloromethane is typically used as the extraction medium. Soxhlet extraction was performed using a solvent. The extraction process was stopped when the fluorescence of the extract decreased to below level 3 under fluorescent light irradiation. Then, the extract was separated. Solid samples are dried.

6.2.1 Processing of Natural Cross-Section Specimens

6.2.1.1 Use a crusher or impact hammer to perform primary crushing of the rock sample to obtain blocks with exposed natural fracture surfaces.

6.2.1.2 Select blocks free of cracks or impurities, and process them using a cutting machine, using a flat, fresh cross-section as a reference. The thickness of the processed block should be 5mm~20mm, length/width is 5mm~50mm.