



BSI Standards Publication

Natural stone test methods – Petrographic examination

National foreword

This British Standard is the UK implementation of EN 12407:2019. It supersedes BS EN 12407:2007, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/545, Natural stone.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

Natural stone test methods - Petrographic examination

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péetrographique

Prüfverfahren für Naturstein - Petrographische
Prüfung

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European foreword

This document (EN 12407:2019) has been prepared by Technical Committee CEN/TC 246 “Natural stones”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2019, and conflicting national standards shall be withdrawn at the latest by November 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12407:2007.

In comparison with the previous edition, the following changes have been made:

— the changes concern essentially the proper scientific definitions, terminology, and diagrams.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

A petrographic description of natural stones is important not only for the purposes of petrographic classification but also in order to highlight features affecting its chemical, physical and mechanical behaviour. In the same way the determination of the stone's origin could be necessary (e.g. in the case of restoration of historical monuments). It is therefore essential to characterize the natural stones for their mineral components and for their fabric and structure but also in terms of any features as: colour, presence of veins, of fossils, of discontinuities, etc.

To ensure that the petrographic classification is objective, it is essential that the characterization of the material is, as far as possible, quantitative.

The interpretation of the results obtained from the petrographic examination of natural stone should include evidences of a possible relationship between petrographic features and technical properties (pores/cleavages/schistosity with water absorption/gelivity/flexure resistance etc.).

1 Scope

This document specifies methods for making technical petrographic descriptions of natural stone, except for roofing slates. For this product, the method for the petrographic examination is defined in EN 12326-2. Although chemical and physical methods of analysis are required for petrographic classification of some stone types, these methods will not be described in this standard.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12440, *Natural stone - Denomination criteria*

EN 12670, *Natural stone - Terminology*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Symbols

vol.% unit of the volume percentage of the mineral phase present in the sample.

5 Principle

A macroscopic description of the sample is undertaken at first. The macroscopic description may involve a visual inspection aided by a hand lens or a stereoscopic microscope. Then one or more thin sections prepared from the sample are examined using an optical polarized transmitted light microscope in order to give a microscopic description and modal analysis (volume proportions of mineral phases) of the sample; where appropriate an additional polished section shall be prepared.

Modal analysis is the most accurate determination of quantitative mineralogical composition of natural stones. It attributes to each mineral phase a certain percentage (vol.%). Modal analysis is obtained by point counting following a standard procedure on thin sections (at least 44 mm × 28 mm) or using Shvetsov's diagrams (or any other similar diagrams commonly used by petrographers).

6 Apparatus

- 6.1 Hand lens or stereoscopic microscope (if required).
- 6.2 Water cooled rock cutter equipped with a continuous rim and sliding guide.
- 6.3 Automatic grinding machine or manual grinding machine with a cast-iron lapidary.
- 6.4 Electrical heating plate.
- 6.5 Bonding press.

6.6 Extractor hood.

6.7 Glass plate c. 300 mm × 400 mm × 10 mm.

6.8 Soft bristle brush.

6.9 Ultrasonic tank.

6.10 Polarized transmitted light optical microscope.

6.11 Point counter and image analysis system (if required).

6.12 Reactives and products as e.g.: emery with varying grain size (30 µm to 10 µm), epoxy resin, Canada balsam, supporting glass (at least 28 mm x48 mm x1,8 mm), cover glass (24 mm x32 mm), diamond disks, xylene and ethanol, amaranth, sodium cobaltinitrite, hydrofluoric acid, hydrochloric acid, sulphosodic alizarin.

To facilitate the identification of some minerals with similar colours or optical properties it might be necessary in many cases to use different techniques such as: selective mineral staining methods, optical cathodoluminescence, XRD, SEM-EDS or WDS microprobe. If required, these methods should be clearly stated in the working order referring to widely-referenced manuals, but taking into account that such additional techniques are not part of the petrographic analysis described in this standard.

7 Preparation of thin and polished sections

7.1 General

Sampling is not responsibility of the test laboratory except where specially requested.

The dimensions of the sample shall be large enough to be representative of the petrographic characteristics of the stone being examined.

One or more thin sections are then prepared.

A thin section is a portion of material mounted on a slide and mechanically reduced to a thin sheet measuring $0,030 \pm 0,005$ mm in thickness, and normally protected by a slide cover. For special purposes (observations under reflected light microscope for the determination of opaque minerals or microprobe analysis) polished thin sections shall be prepared. Polished sections have one side polished with a first polishing paste (in the range of ± 5 µm to 12 µm grade) and a second paste (in the range of ± 6 µm, 3 µm and 1 µm).

The section normally measures about 44 mm × 28 mm, but in the case of coarser grain size stones, larger dimensions may be used (e.g. 75 mm × 50 mm) or several sections of normal dimensions can be prepared. If the rock texture is anisotropic it is necessary to prepare at least two sections with different orientation with respect to the anisotropy (e.g. parallel and perpendicular to anisotropy planes).

Preparation of thick sections

The sample shall be sufficiently coherent so as not to disintegrate when cut. If the stone is brittle or fragile, it will be necessary to strengthen it by means of impregnation, preferably in a vacuum, with resins with an index of refraction approximately 1,54 (e.g. epoxy resins).

By using the rock saw, several small blocks are cut of dimensions in the range of at least ± 4 -5 cm × ± 3 -4 cm and thickness in the range of ± 3 to 4 mm thick. In case of porous samples pores are filled with Canada balsam (or any synthetic resin with approximately equivalent refractive index); the samples are then heated on the plate to approximately 100 °C and then cooled.