



# SLOVENSKI STANDARD

## SIST EN 623-1:2000

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### Advanced technical ceramics - Monolithic ceramics - General and textural properties - Part 1: Determination of the presence of defects by dye penetration tests

Advanced technical ceramics - Monolithic ceramics - General and textural properties - Part 1: Determination of the presence of defects by dye penetration tests

Hochleistungskeramik - Monolithische Keramik - Allgemeine und strukturelle Eigenschaften - Teil 1: Prüfung auf Anwesenheit von Oberflächenfehlern durch Farbstoffeindringtests

Céramiques techniques avancées - Céramiques monolithiques - Propriétés générales et texturales - Partie 1: Détermination de la présence de défauts à l'aide d'essai de ressuage

**Ta slovenski standard je istoveten z: EN 623-1:1995**

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EUROPEAN STANDARD

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English version

**Advanced technical ceramics - Monolithic  
ceramics - General and textural properties - Part 1:  
Determination of the presence of defects by dye  
penetration tests**

Céramiques techniques avancées - Céramiques monolithiques - Propriétés générales et texturales - Partie 1: Détermination de la présence de défauts à l'aide d'essai de ressuage

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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# CEN

European Committee for Standardization  
Comité Européen de Normalisation  
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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## Foreword

This European Standard has been prepared by the Technical Committee CEN/TC 184 "Advanced technical ceramics", the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by July 1995, and conflicting national standards shall be withdrawn at the latest by July 1995.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

EN 623 consists of four Parts.

- Part 1 : Determination of the presence of defects by dye penetration tests
- Part 2 : Determination of density and porosity
- Part 3 : Determination of grain size (ENV)
- Part 4 : Determination of surface roughness (ENV)

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## 1 Scope

This Part of EN 623 describes qualitative methods for determination of the presence of defects in advanced monolithic technical ceramics by dye penetration tests. The results are reported as visual observations of dye penetration.

Three methods are described:

Method A: A fuchsine dye test (see 5.1) which is suitable for white or pale coloured ceramic products, performed using an evacuation technique.

Method B: A fluorescent dye test (see 5.2) which is suitable particularly for those products where the purple fuchsine has insufficient visual contrast with the ceramic, performed using a proprietary test kit.

Method C: A fuchsine dye test (see 5.3) which is performed by simple immersion in or spraying with a dye solution, suitable for routine testing for major defects.

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NOTE 1 : It is important to note that these methods allow only certain types of defects to be detected. Defects which are not revealed by these methods, but which may influence properties and performance include cracks or pores not connected to the surface, inclusions, certain types of grinding damage, and residual stresses.

NOTE 2 : Interpretation of results may become more difficult with increasing porosity of the test pieces.

NOTE 3 : General principles of dye penetration tests may be found in EN 571-1. A test suitable for high voltage insulators using high pressure dye penetration is cited in IEC 672. This test is more searching for open porosity than any of the above methods.

## 2 Normative reference

This European standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ENV 1006 Advanced technical ceramics - Methods of testing monolithic ceramics - Guidance on the sampling and selection of test pieces.

### 3 Apparatus

- 3.1 For method (A), evacuating equipment, capable of reducing the pressure to a value not greater than 2500 Pa, having a means of measuring the pressure used.
- 3.2 Drying oven, capable of maintaining a temperature of  $110\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ .
- 3.3 Open mesh container, fabricated from ceramic or other non-metallic material, and of size appropriate to the test pieces (see clause 4).
- 3.4 For method (B), a source of ultraviolet light.
- 3.5 For method (A), an airtight vessel.
- 3.6 Low power microscope.
- 3.7 Appropriate dye solutions.

### 4 Test pieces

Materials for testing should be sampled in accordance with the guidance given in ENV 1006. Test pieces should be whole items, or, where this is not possible, fragments of ceramic products in which broken surfaces are exposed.

Where required, test pieces should be conditioned to remove absorbed organic material, such as grinding coolant. This may be done by firing in an oxidizing atmosphere to  $600\text{ }^{\circ}\text{C} \pm 50\text{ }^{\circ}\text{C}$ , maintaining this temperature for 2 h. If this treatment leads to annealing or oxidation of the surface of the test piece, use an alternative treatment, e.g. 2 h at  $400\text{ }^{\circ}\text{C} \pm 50\text{ }^{\circ}\text{C}$  in a vacuum oven.

### 5 Procedure

**5.1 Method A: Fuchsine dye test using evacuation.** Place the dry test pieces in the container (see 3.3) and immerse the container in a solution of fuchsine dye in industrial methylated spirits ((ethanol) concentration 16 g/l), contained in an airtight vessel.

NOTE 1 : The choice of solvent for the dye may be important in tests on non-oxide materials. Normally, for oxides, industrial methylated spirits (ethanol) is adequate, but if problems of wetting arise it is necessary to experiment with different solvents. Necessary precautions in handling solvents should be taken.

Seal the vessel and reduce the pressure using the evacuating equipment (see 3.1), until the solution boils. Maintain this reduced pressure for 5 min.

Allow the contents of the vessel to return to atmospheric pressure, and remove the test pieces from the solution. Thoroughly wash the test pieces with a warm solution of soap or detergent to remove surface dye.

NOTE 2 : Mechanical brushing may be used.

Rinse the test pieces in water, and dry them in air at  $110\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ .

Examine the test pieces under good illumination, by eye or with a low power microscope, according to the size of the features expected.

**5.2 Method B: Fluorescent dye test.** Place the dry test pieces in the container (see 3.3) and immerse the container in a solution of fluorescent penetration fluid, obtained from a dye penetration kit.

NOTE 1 : This test is carried out at ambient temperature and pressure.

After 15 min, remove the excess fluid in accordance with the instruction for the dye kit. Should the instructions specify a developer, follow the procedure given so that all surfaces of the test pieces are evenly coated. Examine the test pieces under ultraviolet light. [SIST EN 623-1:2000](https://standards.iteh.ai/catalog/standards/sist/c8298b6c-e6f9-4a98-804a-471437a3c8e8/sist-en-623-1-2000)

NOTE 2 : Ultraviolet lamps should be operated in accordance with the manufacturers safety instructions.

**5.3 Method C: Fuchsine dye test using immersion or spraying.** For the immersion test, place the dry test pieces in the container (see 3.3) and immerse the container in a solution of fuchsine dye in industrial methylated spirits (ethanol) (concentration 16 g/l). See 5.1, note 1. Alternatively, a fuchsine dye testing kit may be used. Agitate the container for at least 30 s and remove from the solution.

For the spraying test, spray the test-pieces with fuchsine dye solution prepared as above until all surfaces are well covered. Allow to stand for at least 30 s.

Thoroughly wash the test-pieces with warm solution of soap or detergent to remove surface dye.

NOTE 1 : Mechanical brushing may be used.

Rinse the test pieces in water and dry them in air at  $110\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ . If appropriate, apply the dye testing kit developer.



Examine the test pieces under good illumination, by eye or with a low power microscope according to the size of the features expected.

NOTE 2 : This procedure is not as rigorous as Method A, but is generally adequate for inspection of significant cracking or porosity.

## 6 Examination

The presence of dye coloration after any of the tests is an indication of penetration via cracks or other defects. The report shall include details of observations as follows:

- a) Clearly defined localized or linear penetration showing the presence of discrete surface defects or cracks

NOTE 1 : The presence of dye may be confirmed by breaking the test pieces to observe a cross-section.

NOTE 2 : The determination of the presence of small defects ( $< 50 \mu\text{m}$ ) is uncertain and depends on the techniques employed.

- b) General surface absorption

NOTE 3 : Strong surface absorption of dye, especially fuchsine dye (see 5.1) is indicative either of surface porosity in unmachined ceramics only, or of surface damage and micro-cracking in machined and unmachined ceramics, or both.

- c) No effect.

NOTE 4 : If no effect is observed when testing a material for the first time, a check on the ability of the solvent to wet the ceramic is recommended. The solvent should be changed and the test repeated if there is any doubt.

## 7 Test report

The test report shall include the following information:

- a) the name of the testing establishment;
- b) the date of the test, unique identification of report and each page, customer name and address, and signatory;
- c) a reference to this European standard, i.e. 'Determined in accordance with EN 623-1.
- d) the description of the test material (material type, manufacturing code, batch number, date of receipt;