SLOVENSKI STANDARD
oSIST prEN 17393:2019

01-september-2019

Vroče brizganje - Preskus natezne trdnosti cevnih prevlek

Thermal spraying - Tubular coating tensile test

Thermischen Spritzen - Schichtzugversuch

Projection thermique - Essai de traction

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ICS:

25.220.20 Površinska obdelava Surface treatment

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EUROPEAN STANDARD

NORME EUROPÉENNE

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DRAFT
prEN 17393

June 2019

ICS 25.220.20

English Version

Thermal spraying - Tubular coating tensile test

Projection thermique - Essai de traction

Thermisches Spritzen - Schichtzugversuch

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 240.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 17393:2019) has been prepared by Technical Committee CEN/TC 240 “Thermal spraying and thermally sprayed coatings”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

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Introduction

The determination of tensile strength of a thermally sprayed coating can be of substantial importance regarding product-supporting quality control as well as coating development and, moreover, can have an effect on important factors such as transfer efficiency, microstructure, surface quality, etc. Only a little effort is required to carry out the tubular coating tensile test (TCTT). However, it provides reproducible values for the mechanical strength of sprayed coatings and gives information on influences resulting from spraying conditions.

Microscopic examinations of the fractured surface can provide further information for the quality assessment of the coating's microstructure and for the assessment of influences resulting from loads during the TCTT test.

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1 Scope

This document specifies the procedure for the determination of coating strength, and hence of cohesive strength in a tubular coating tensile test.

The test is intended to determine the tensile coating strength parallel to the spray layers (normal to the spray direction) and to identify differences in particle bond quality.

The tubular coating tensile test is suitable for sprayed coatings deposited using metallic materials (not carbides and ceramics).

The tubular coating tensile test is not suitable for fused sprayed coatings deposited using self-fluxing alloys.

The test supports quality assurance and is intended to be applied for the purpose of coating optimization by identifying the influences of coating parameters and spray materials on the coatings's quality. Furthermore, the coating in particular for cold sprayed coatings can be compared with the characteristics of similar solid materials and the coating's quality can be assessed.

This test is not recommended for thin coatings (coating thickness < 500 µm), since massive scattering of results is to be expected here. Due to the size of the specimens, it is particularly suitable to apply the tubular coating tensile test for coating processes that use a concentrated spray jet and a highly focused spray spot, as in the case of cold spraying, high velocity flame spraying (HVOF) or plasma spraying. Applying the tubular coating tensile test for coating processes that use a broad spray jet, such as flame spraying and arc spraying, may require special spraying measures, e.g. the use of a template to ensure a nearly vertical impingement angle.

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 ISO 14916, *Thermal spraying — Determination of tensile adhesive strength (ISO 14916)*

EN ISO 14917, *Thermal spraying — Terminology, classification (ISO 14917)*

EN ISO 7500-1:2018, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system (ISO 7500-1:2018)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 14917 and the following apply.

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

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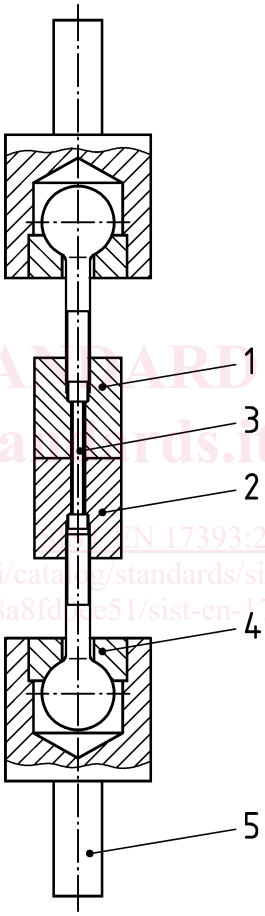
3.1
tensile coating strength
$R_{m,TCT}$
tensile strength of the coating determined in a tension test, parallel to the coating layers (normal to the spray direction), which is calculated from the quotient of the maximum load F_m and the coating's cross-section

4 Testing equipment

A tensile testing machine in accordance with EN ISO 7500-1:2018, class 1, shall be used having a suitable clamping system to ensure concentric clamping and loading of the specimens, see Figure 1.



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Key

1	substrate 1
2	substrate 2
3	fixing screw
4	ball joint
5	clamping part

Figure 1 — Tubular coating tensile test arrangement

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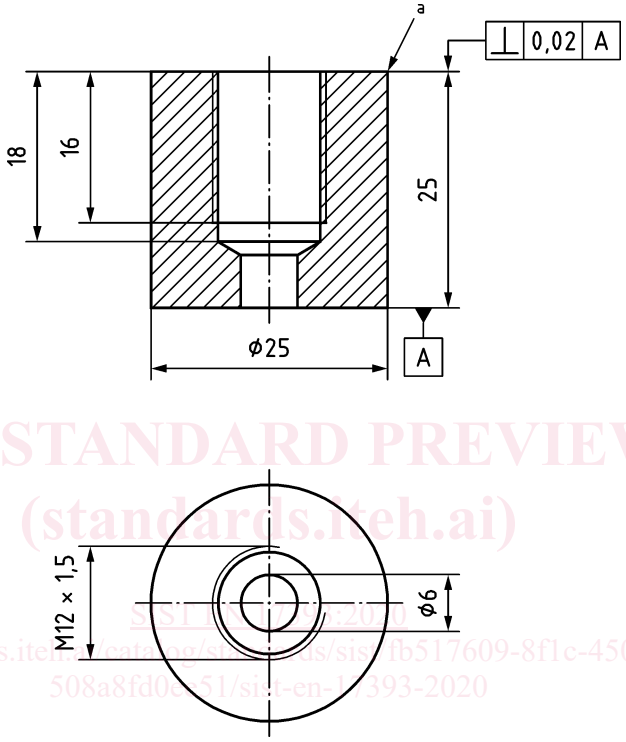
5 Specimens

5.1 Shape of base samples

The base samples are made of aluminium or non alloy steel. Their outer dimensions shall be equal to those of the specimens used in the determination of tensile adhesive strength according to EN ISO 14916 (diameter: 25 mm or 40 mm), and they have a central bore (6 mm through bore) for fixation, see Figure 2. Rounding or chamfering the front face is not permitted.

Dimensions in millimetres



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Key

a sharp edge

Figure 2 — Base sample

5.2 Preparation of the specimen to be sprayed

Install the base samples in the fixture, see Figure 3, and adjust them to the maximum common diameter (tolerance ± 0,02 mm) using a lathe. A uniform surface quality R_Z of about 40 µm shall be achieved. This type of levelling is important, because otherwise a discrepancy between the two cylinders would significantly weaken the coating that is to be applied. The diameter that is reached, D_i, which is represented in the drawing as the outer diameter of the specimen (underneath the coating), shall be recorded.

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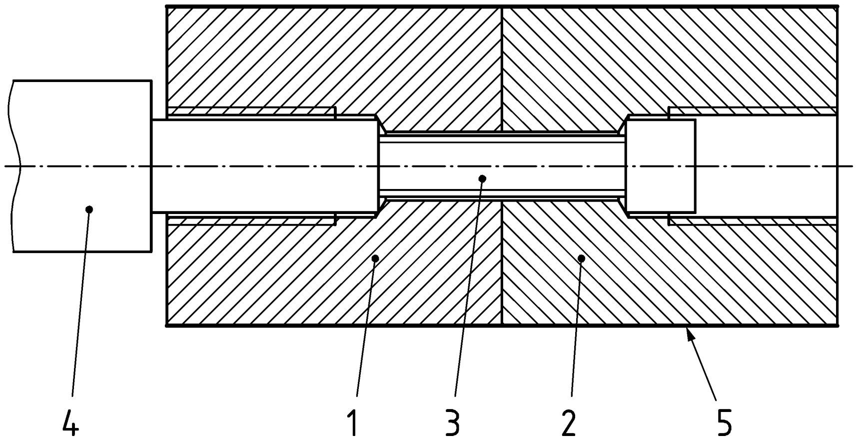

Key

1 substrate 1

2 substrate 2

3 fixing screw

4 fixture

5 coating

Figure 3 — Specimen to be sprayed (consisting of 2 base samples)

5.3 Specimen to be sprayed, preparation and coating

The preparation of the specimen to be sprayed as well as the spraying parameters, such as the spraying procedure, spray material, coating thickness, energy data, movement pattern, etc., shall be in accordance with the specifications for the spraying procedure of the corresponding workpiece.

The rotating specimen to be sprayed shall be coated over the entire length of its outer surface.

The temperature of the specimen to be sprayed shall under no circumstances exceed those values reached when spraying the corresponding workpiece, which can occur particularly when applying coatings of larger thicknesses. The prepared specimen to be sprayed can be removed from the fixture and the central fixing and can be directly tested in a tensile testing machine using the same clamping devices as in the tensile adhesive strength test according to EN ISO 14916. See Figure 1 in Clause 4.

5.4 Determination of outer diameter

After spraying, and before the test, the outer diameter shall be measured in at least 3 points along the surface of the cylinder length of the spray specimen, where one section shall be on the junction between the base samples. For each measurement section, the diameter shall be measured rotated by 90°, and the mean value shall be calculated.

The maximum diameter tolerance is ± 0,01 mm.

Only suitable instruments, which need to be calibrated and traceable to national standards, shall be used during measurement. They shall be capable of measuring the diameter with an accuracy of at least 0,01 mm.

5.5 Number of specimens to be tested

Three specimens, which have been coated in one spray cycle using identical process parameters, shall be tested.