SLOVENSKI STANDARD
SIST EN 17393:2020

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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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25.220.20 Površinska obdelava Surface treatment

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English Version

Thermal spraying - Tubular coating tensile test

Projection thermique - Essai de traction

Thermisches Spritzen - Schichtzugversuch

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European foreword

This document (EN 17393:2020) has been prepared by Technical Committee CEN/TC 240 “Thermal spraying and thermally sprayed coatings”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by January 2021, and conflicting national standards shall be withdrawn at the latest by January 2021.

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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 (TCT). 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 on failure modes and support the quality assessment of the coating microstructure as well as the assessment of influences resulting from loads during the TCT test.

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 cohesion quality, as caused by defects as internal delamination at cracks or oxides between the spray particles or splats.

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 specimen, 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:

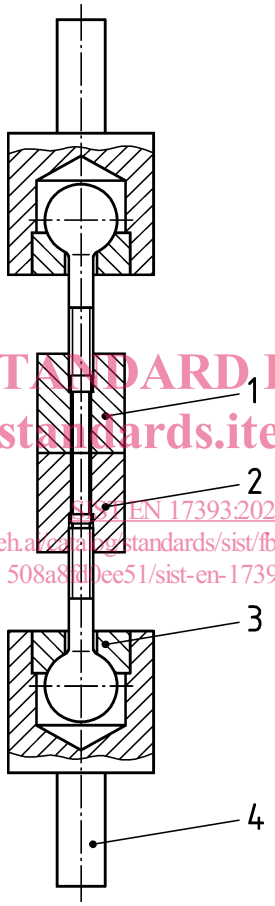
— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

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.



Key
1 substrate 1
2 substrate 2
3 ball joint
4 clamping part

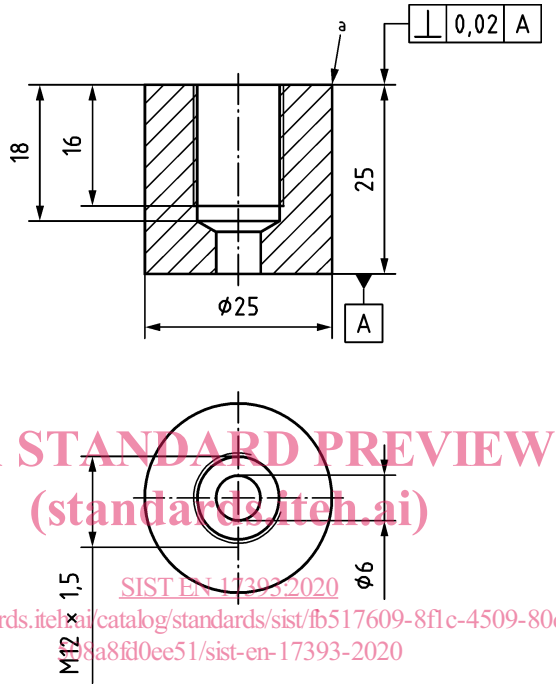
Figure 1 — Tubular coating tensile test arrangement

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



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 *Rz* 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.