Irish Standard
I.S. EN ISO 12679:2015

Thermal spraying - Recommendations for thermal spraying (ISO 12679:2011)

I.S. EN ISO 12679:2015

Incorporating amendments/corrigenda/National Annexes issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:	*Published:*
EN ISO 12679:2015	2015-10-14

This document was published under the authority of the NSAI and comes into effect on:	ICS number:
2015-11-02	25.220.20
	NOTE: If blank see CEN/CENELEC cover page

NSAI	T +353 1 807 3800	Sales:
1 Swift Square,	F +353 1 807 3838	T +353 1 857 6730
Northwood, Santry	E standards@nsai.ie	F +353 1 857 6729
Dublin 9	W NSAI.ie	W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

National Foreword

I.S. EN ISO 12679:2015 is the adopted Irish version of the European Document EN ISO 12679:2015, Thermal spraying - Recommendations for thermal spraying (ISO 12679:2011)

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with this document does not of itself confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

This page is intentionally left blank

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 12679

October 2015

ICS 25.220.20

Supersedes EN 14616:2004

English Version

Thermal spraying - Recommendations for thermal spraying (ISO 12679:2011)

Projection thermique - Recommandations pour la projection thermique (ISO 12679:2011)

Thermisches Spritzen - Empfehlungen für das thermische Spritzen (ISO 12679:2011)

This European Standard was approved by CEN on 27 September 2015.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN ISO 12679:2015 E

Contents

Page

European foreword

The text of ISO 12679:2011 has been prepared by Technical Committee ISO/TC 107 “Metallic and other inorganic coatings” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 12679:2015 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 April 2016, and conflicting national standards shall be withdrawn at the latest by April 2016.

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

This document supersedes EN 14616:2004.

According to the CEN-CENELEC Internal Regulations, the national standards organizations 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 12679:2011 has been approved by CEN as EN ISO 12679:2015 without any modification.

This page is intentionally left blank

I.S. EN ISO 12679:2015

INTERNATIONAL STANDARD

ISO 12679

First edition
2011-09-15

Thermal spraying — Recommendations for thermal spraying

Projection thermique — Recommandations pour la projection thermique

Reference number
ISO 12679:2011(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 12679 was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*.

Introduction

Thermal spraying encompasses processes used in the production of coatings and free-standing bodies for which spray materials are surface-melted, melted off or melted and then propelled onto suitably prepared workpiece surfaces. The workpiece surfaces are not surface-melted. In order to achieve specific coating properties, the spray coating can undergo additional post-treatment, either thermal or otherwise, for example, sealing.

Thermally sprayed coatings serve to improve the surface properties of a workpiece by manufacturing or repair operations. This can be done, for example, in relation to wear, corrosion, heat transfer or heat insulation, electrical conductivity or insulation, appearance and/or for restoring the part to working order. In certain cases, a spray coating can render a surface solderable.

Chiefly due to their bonding mechanism, thermally sprayed coatings without thermal post-treatment can be distinguished from coatings applied with other processes, such as deposition welding, brazing, physical vapour deposition (PVD) or chemical vapour deposition (CVD).

The advantages of thermal spraying are the following.

— The workpieces to be coated are only slightly heated so that distortion and any other undesired structural changes to the parent material are avoided. This does not apply if the coatings are thermally treated during or after the spraying process.

— The application is not dependent on the size of the workpiece or component. The operation can be stationary or mobile depending on the spraying process.

— Even geometrically complex components can be coated using the appropriate spray set-up.

— The untreated surface of spray coatings generally provides a good bond coat for painting.

— Depending on the spraying process and spray material, different coating thicknesses can be applied, although a coating thickness of approximately 10 µm is currently considered to be the lower limit.

Process-related disadvantages are as follows:

— the bond strength of thermally sprayed coatings without thermal post-treatment derives from adhesive forces only;

— the bond strength can be influenced due to an expansion mismatch between the coating and substrate material, especially in the case of a high operation temperature;

— spray coatings are micro-porous;

— the thicker the spray coating, the higher the residual stresses in the coating, and the degree of multi-axial stress thus increases;

— spray coatings without additional thermal post-treatment are sensitive to edge pressure, localized and linear loads and to impact stresses;

— there are restrictions in relation to the geometric dimensions, for example, for the inner coatings of workpieces whose inner diameter is too small.

Thermal spraying — Recommendations for thermal spraying

1 Scope

This International Standard includes general guidelines for the workmanlike production of metallic, metal-ceramic, oxide-ceramic and plastic coatings, by means of thermal spraying on metallic and non-metallic parent materials.

This International Standard provides recommendations for an appropriate and practical spray set-up, faultless manufacturing, monitoring, quality assurance and for non-destructive and destructive tests on the component and accompanying specimen. It describes details about negative effects which can occur. It also gives advice on how to prevent such effects.

Permissible coating loads and evaluation categories for quality are not the subject of this International Standard, as they are dependent on the operating conditions.

This International Standard can be used for contract purposes.

2 Normative references

The following referenced documents are indispensable for the application 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.

ISO 3452-1, *Non-destructive testing — Penetrant testing — Part 1: General principles*

ISO 14231, *Thermal spraying — Acceptance inspection of thermal spraying equipment*

ISO 14232, *Thermal spraying — Powders — Composition and technical supply conditions*

ISO 14918, *Thermal spraying — Approval testing of thermal sprayers*

ISO 14919, *Thermal spraying — Wires, rods and cords for flame and arc spraying — Classification — Technical supply conditions*

ISO 14920, *Thermal spraying — Spraying and fusing of self-fluxing alloys*

ISO 14921, *Thermal spraying — Procedures for the application of thermally sprayed coatings for engineering components*

ISO 14922-1, *Thermal spraying — Quality requirements of thermally sprayed structures — Part 1: Guidance for selection and use*

ISO 14922-2, *Thermal spraying — Quality requirements of thermally sprayed structures — Part 2: Comprehensive quality requirements*

ISO 14922-3, *Thermal spraying — Quality requirements of thermally sprayed structures — Part 3: Standard quality requirements*

ISO 14922-4, *Thermal spraying — Quality requirements of thermally sprayed structures — Part 4: Elementary quality requirements*

ISO 14923, *Thermal spraying — Characterization and testing of thermally sprayed coatings*

ISO 14924, *Thermal spraying — Post-treatment and finishing of thermally sprayed coatings*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
shot-peening effect
pressure strengthening by grit-blasting

3.2
sound pressure level
mean value of emitted sound

NOTE Sound pressure level is measured in decibels (dB).

3.3
etching
removing of surface material

NOTE Etching can be applied using liquid agents (wet chemical etching) or using gases in a recipient (dry etching, plasma etching). The etching agent reacts chemically with the substrate.

3.4
ion-etching
material removed by shooting the surface with high-energetic particles like ions

NOTE The ions cut off material at the impact point. The procedure is used in plasma technology application (vacuum coating technology).

3.5
corona discharge
dielectric discharge in air after exceeding the break-down field intensity; air molecules will be ionized by generating short-living ozone

4 Parent material

Virtually every kind of solid-state material can be coated by means of thermal spraying, provided its surface is suitably prepared. The achievable bond strength of the coating to the substrate is dependent on the spray material, spraying process and the physical and technological properties of the parent material used. The bond strength, amongst other things, is particularly influenced by the thermal conductivity of the parent material in comparison to the conductivity of the spray coating and the state of the parent material's surface. In general, hardened materials need a bond coat to give adequate bond strength. The possible coating thickness may be limited, depending on the bonding material being used. Certain surface-hardening processes, e.g. "nitriding", may leave gaseous inclusions which would prevent proper bonding.

A variety of plastics, as well as glass and paper, can be thermally sprayed when using the appropriate spraying process and a surface treatment method adapted for the respective material.

As the workpieces to be coated by means of thermal spraying are generally only slightly heated, undesired structural changes to the parent material and changes to the component's geometry due to distortion are avoided to the greatest possible extent. However, distortions resulting from intensive grit-blasting during surface preparation, especially with thin-walled parts or as a result of residual compressive stresses on the surface of the substrate caused by process-related shot-peening effects, can occur. If coatings are thermally treated during spraying (processes with simultaneous fusing) or subsequently, undesired structural changes and significant geometric changes can occur.

For purposes of quality assurance during the manufacturing process, the parent materials and components to be coated should be stored in such a way that damage and/or undesired changes to the shape or surface are avoided.