SLOVENSKI STANDARD
SIST EN 1274:2004

01-december-2004

Nadomeģ a:
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Vroļ e brizganje - Prahovi - Sestava, tehniļ ni dobavni pogoji

Thermal spraying - Powders - Composition, technical supply conditions

Thermisches Spritzen - Pulver - Zusammensetzung, technische Lieferbedingungen

Projection thermique - Poudres - Composition, conditions techniques de livraison

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Ta slovenski standard je istoveten z: EN 1274:2004

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ICS:

25.220.20	Površinska obdelava	Surface treatment
77.160	Metalurgija prahov	Powder metallurgy

SIST EN 1274:2004 **en**

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1274

November 2004

ICS 25.220.20; 77.160

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English version

Thermal spraying - Powders - Composition, technical supply conditions

Projection thermique - Poudres - Composition, conditions techniques de livraison

Thermisches Spritzen - Pulver - Zusammensetzung, technische Lieferbedingungen

This European Standard was approved by CEN on 13 September 2004.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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Foreword

This document (EN 1274:2004) 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of an identical text or by endorsement, at the latest by May 2005, and conflicting national standards shall be withdrawn at the latest by May 2005.

This document supersedes EN 1274:1996.

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

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Introduction

The document has been aimed to designate the most important thermal spray-coating powders on the basis of their composition, their manufacturing process and their particle size distribution. The majority of commercially available powders is covered by and can be characterised and specified according to this document.

The document is meant to simplify understanding of the great product variety on the market for the manufacturer and user, and nevertheless offer a vast choice.

Due to the number of the spray powders referred to in this document, in some cases abbreviations are used.

Exception is granted to details on the properties of sprayed coatings. Such properties resulting from spraying conditions not covered by this document, e.g. gas composition, deposition efficiency, material flow rate, stand off distance, etc., can differ greatly from the properties of the original powder.

Applications of powders for thermal spraying have been explicitly described in the relevant literature; therefore, a separate outline in this place is not necessary.

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1 Scope

This document covers powders, which are currently applicable in thermal spraying on the basis of their physical and chemical properties. This document specifies the composition and technical supply conditions of powders for thermal spraying.

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.

EN 10204, *Metallic products — Types of inspection documents.*

EN 23923-2, *Metallic powders — Determination of apparent density — Part 2: Scott volumeter method (ISO 3923-2:1981).*

EN 23954, *Powders for powder metallurgical purposes — Sampling (ISO 3954:1977).*

EN ISO 4490, *Metallic powders — Determination of flow time by means of a calibrated funnel (Hall flowmeter) (ISO 4490:2001).*

ISO 565, *Test sieves – Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings.*

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3 Properties and property determination of powders for thermal spraying

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3.1 Sampling and sample splitting

Sampling and sample splitting is to be done from a homogeneous mixture uniform in particle size. Directions for adequate methods and equipment shall be as included in EN 23954.

3.2 Chemical composition

The chemical composition shall be defined by any suitable testing procedure, e.g. wet chemical processes, atomic absorption spectrometry, flame emission spectroscopy, X-ray fluorescent analysis.

3.3 Particle size range

Powders for thermal spraying always show a distribution of different particle sizes. This particle size distribution (PSD) has an immense influence on the melting and the feedability the powder and thus, among other things, essential properties of the coating are assigned. The measuring of the PSD shall be made by standardised sieve analysis according to ISO 565 or better by optical measuring methods e.g. laser beam scattering because of its high accuracy and reproducibility.

Usually, the results of the different measuring procedures and also measuring devices do not coincide, even when identical powders are used. Therefore, when comparing particle size distributions or when alternating the particle size measuring procedure a correlation of the measurement results is necessary. For this reason it is essential to always indicate the measuring procedure together with the measurement results.

The minimum requirement in a powder according to this document is that it is permitted to exceed the upper limit of the PSD up to the next but one standard screen size and to under run the PSD lower limit by a maximum of 10 mass %. It should be noted, that the data for upper and lower limit depend on the chosen measuring procedure and when evaluating powders for HVOF (high velocity oxygen fuel-flame spraying)

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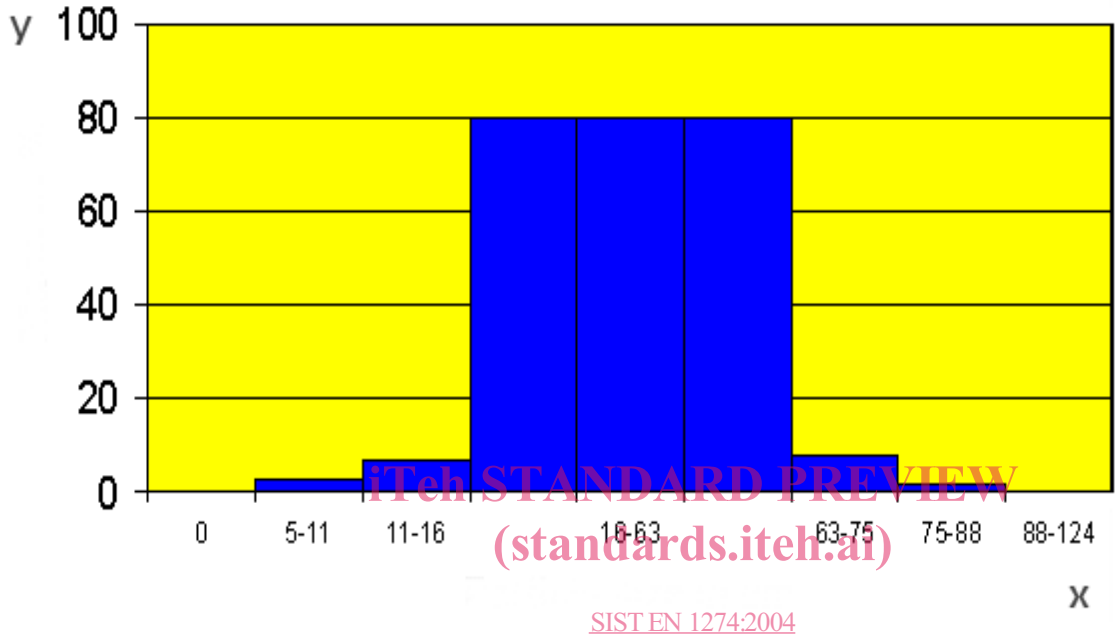
special attention should be paid to fine particles (dust) because of their effect on the feeding and melting properties of the powder. Further these fine dust particle can clog the spray nozzle and so stop the whole coating process. For powders, which e.g. are used in the coating of turbine components, there are other restrictions on these tolerances, e.g. to 5 %, as well as the specification of particle size ranges with corresponding tolerance ranges between upper and lower limit. This, however, often leads to increased manufacturing costs of powder. These additional requirements in the measuring and the description of the measured values exceed the minimum requirements of this document and have to be stipulated between the powder supplier and the user in the technical delivery conditions (see Figure 1).



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Key
x Particle size in µm
y Mass in %

Figure 1 — Typical size distribution 63/16 µm

3.4 Manufacturing process – particle shape

The manufacturing process of powder shall be indicated. Using a term such as, for instance, fusing, sintering, agglomeration atomisation. The particle shape and its surface can be illustrated by means of scanning electron or stereo microscopy. In order to check for similarity the images can be compared to reference samples provided by the manufacturer.

Example Figures are included in Annex A.

3.5 Apparent density

Apparent powder density shall be determined as specified in EN 23923-2, and to be expressed as g/cm^3.

3.6 Flowability

The determination of the flowability of free flowing powders shall be effected according to EN ISO 4490 and expressed as s/50 g. As especially fine powders with a low specific weight are often not able to flow, it is not possible to determine the flowability in these cases.

The results of the measurements of apparent density and flowability are determined by several properties of material and powder, as e.g. specific weight of the material, particle shape and structure of the powder particle

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and size distribution. Corresponding measured values and tolerances are to be stipulated between the supplier and the user if these characteristics of the powder shall be stated in the technical delivery conditions.

3.7 Microstructure

The microstructure of a powder particle can be represented in a metallographically prepared cross-section. The preparation method is of decisive importance, and should, therefore, be agreed upon between manufacturer and user.

3.8 Determination and composition of phases

Determination of phases as regards type, quantity, shape, configuration, composition and size, in polyphase powders can be made by. e.g. X-ray microstructure analysis, scanning electron microscope (SEM), energy dispersive X-ray analysis (EDX), metallographic or quantitative image analysis.

3.9 Summary

Each powder for thermal spraying according to this standard shall be characterised at least by the chemical composition, particle size distribution and measuring procedure and manufacturing process of the powder.

4 Classification of powders

4.1 General

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The powders for thermal spraying are categorised on the basis of their chemical composition into:

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— pure metals;

— metallic alloys and composites;

— carbides, carbides with metals, carbides with metallic alloys and composites;

— oxides;

— organic materials.

Blended powders of several varying components are not itemised because of their infinite possible number. All percentages given in mass %.

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4.2 Pure metals

Table 1 — Pure metals

Code No.	Main constituent	Chemical composition in %					
		O max.	C max.	N max.	H max.	Al max.	Co max.
1.1	Ti 99	0,3	0,3	0,3	0,1	-	-
1.2	Nb 99	0,3	0,3	0,3	0,1	-	-
1.3	Ta 99	0,3	0,3	0,3	0,1	-	-
1.4	Cr 98,5	0,8	0,1	0,1	-	0,5	-
1.5	Mo 99	0,3	0,15	0,1	-	-	-
1.6	W 99	0,3	0,15	0,1	-	-	0,3
1.7	Ni 99,3	0,5	0,1	0,1	-	-	-
1.8	Cu 99	-	-	-	-	-	-
1.9	Al 99	0,5	-	-	-	-	-
1.10	Si 99	-	-	-	-	-	-
1.11	Sn 99,9	-	-	-	-	-	-
1.12	Zn 99,5	-	-	-	-	-	-

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4.3 Metal alloys and composite material

4.3.1 Self-fluxing alloys

Table 2 — Self-fluxing alloys

Code No.	Match Code	Hardness HRC	Chemical composition in %									
			C	Ni	Co	Cr	Cu	W	Mo	Fe	B	Si
2.1	NiCuBSi 76 20	35 to 40	max. 0,05	Rem	-	-	19 to 21	-	-	max. 0,5	0,9 to 1,3	1,8 to 2,0
2.2	NiBSi 96	15 to 30	max. 0,2	Rem	-	-	-	-	-	max. 2,0	1,0 to 4,0	2,0 to 5,0
2.3	NiCrBSi 90 4	30 to 35	0,1 to 0,2	Rem	-	3 to 5	-	-	-	max. 1,0	1,4 to 1,8	2,8 to 3,6
2.4	NiCrBSi 86 5	30 to 35	0,1 to 0,3	Rem	-	4 to 6	-	-	-	3,0 to 5,0	0,8 to 1,2	2,8 to 3,2
2.5	NiCrBSi 88 5	30 to 35	0,1 to 0,4	Rem	-	3 to 6	-	-	-	1,0 to 2,0	1,0 to 2,2	3,0 to 4,2
2.6	NiCrBSi 83 10	35 to 40	0,1 to 0,3	Rem	-	8 to 12	-	-	-	2,0 to 4,0	2,0 to 2,8	2,2 to 2,8
2.7	NiCrBSi 85 8	30 to 40	0,1 to 0,4	Rem	-	6 to 10	-	-	-	1,0 to 3,5	1,4 to 2,5	2,6 to 4,0
2.8	NiCrBSi 80 11	40 to 50	0,3 to 0,6	Rem	-	10 to 14	-	-	-	2,0 to 4,0	2,0 to 2,8	3,0 to 4,0
2.9	NiCrBSi 74 15	55 to 60	0,7 to 1,0	Rem	-	15 to 17	-	-	-	3,0 to 5,0	2,8 to 3,6	3,5 to 4,5
2.10	NiCrBSi 74 14	50 to 55	max. 0,05	Rem	-	13 to 15	-	-	-	4,0 to 5,0	2,6 to 3,6	4,0 to 5,0
2.11	NiCrBSi 65 25	≥ 60	0,8 to 1,0	Rem	-	24 to 26	-	-	-	max. 1,0	3,0 to 3,8	4,0 to 4,6
2.12	NiCrBSi 82 7	≥ 60	max. 0,06	Rem	-	6 to 9	-	-	-	2,5 to 3,5	2,5 to 3,5	4,0 to 4,6
2.13	NiCrWBSi 64 11 16	≥ 50	0,5 to 0,6	Rem	-	10 to 12	-	15 to 17	-	3,0 to 4,0	2,2 to 2,8	3,0 to 3,6
2.14	NiCrCuMoBSi 67 17 3 3	60 to 65	0,5 to 0,8	Rem	-	16 to 18	2 to 4	-	2 to 3	2,5 to 4,0	3,0 to 4,0	4,0 to 4,6
2.15	NiCrCuMoWBSi 64 17 3 3 3	55 to 60	0,4 to 0,6	Rem	-	16 to 18	2 to 4	2 to 3	2 to 3	3,0 to 5,0	3,4 to 4,0	4,0 to 4,6
2.16	NiCoBSi 71 20	53 to 58	max. 0,05	Rem	19 to 21	-	-	-	-	max. 0,5	2,6 to 3,2	4,0 to 5,0
2.17	CoCrNiMoBSi 40 18 27 5	55 to 60	max. 0,2	26 to 28	Rem	18 to 20	-	-	4 to 6	max. 2,6	3,0 to 3,6	3,0 to 3,6

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