

FINAL
DRAFT

INTERNATIONAL
STANDARD

ISO/FDIS
14919

ISO/TC 107

Secretariat: KATS

Voting begins on:
2023-08-09

Voting terminates on:
2023-10-04

Thermal spraying — Wires, rods and cords for flame and arc spraying — Classification and technical supply conditions

*Projection thermique — Fils, baguettes et cordons pour projection
thermique à l'arc et au pistolet dans une flamme — Classification et
conditions techniques d'approvisionnement*

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Reference number
ISO/FDIS 14919:2023(E)

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 240, *Thermal spraying and thermally sprayed coatings*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 14919:2015), which has been technically revised.

The main changes are as follows:

- addition of the alloy ZnAl₂, ZnAl₄ and ZnAl₂₂ in [Table 4](#).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Thermal spraying — Wires, rods and cords for flame and arc spraying — Classification and technical supply conditions

1 Scope

This document specifies requirements for classification of metal and non-metal wires (solid and cored), rods, cords processed by means of thermal spraying, especially by arc and flame spraying.

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.

ISO 544:2017, *Welding consumables — Technical delivery conditions for filler materials and fluxes — Type of product, dimensions, tolerances and markings*

ISO 10474:2013, *Steel and steel products — Inspection documents*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

— IEC Electropedia: available at <https://www.electropedia.org/>

4 Classification

4.1 Classification according to the manufacturing process and resulting structure

The thermal spray materials are classified according to the manufacturing process and the resulting structure, as given in [Table 1](#).

Table 1 — Classification of thermal spraying material and resulting structure

Number	Term	Manufacturing process	Structure
1	solid wire/rod	metallurgical manufacturing and forming	homogeneous composition
2	solid wire/rod	powder metallurgical manufacturing and forming	homogeneous composition
3	cored wire (tube shaped wire)	filling up a metal tube and compressed by means of forming	seamless metal shell with powder filling
4	cored wire (folded wire)	forming a metal sheet with powder filling, binder and compressed by means of drawing	metal shell with powder filling
5	cords	simultaneous extruding of powder, binder and organic sheath	plastic shell with powder filling

Table 1 (continued)

Number	Term	Manufacturing process	Structure
6	oxide ceramic rods	extruding and sintering respectively drying of ceramic material	porous rod consisting of bonded ceramic particles

4.2 Classification according to material groups and chemical composition

The material groups are given in [Table 2](#). The chemical composition shall conform to [Tables 3](#) to [10](#).

Table 2 — Classification according to material groups

Code number	Term
1	tin and tin alloys
2	zinc and zinc alloys
3	aluminium and aluminium alloys
4	copper and copper alloys
5	iron and iron alloys
6	nickel and nickel alloys
7	molybdenum
8	oxide ceramics

Table 3 — Tin and tin alloys

Code number	Symbol	Alloying elements % (mass fraction)	Other elements % (mass fraction)	Manufacturing process
1.1	Sn99	Sn ≥ 99,95	total ≤ 0,05 Sb ≤ 0,02 Ag ≤ 0,01 Bi ≤ 0,002 Cu ≤ 0,01 Fe ≤ 0,01 Pb ≤ 0,02 Al+Cd+Zn ≤ 0,002	1
1.2	SnSbCu84	Sb 7 to 8 Cu 3 to 4 remainder Sn	Pb ≤ 0,35 As ≤ 0,1 Bi ≤ 0,08 Fe ≤ 0,1 Al ≤ 0,01 Zn ≤ 0,01 other: total ≤ 0,2	1

Table 4 — Zinc and zinc alloys

Code number	Symbol	Alloying elements % (mass fraction)	Other elements % (mass fraction)	Manufacturing process
2.1	Zn99,99	Zn ≥ 99,99	total ≤ 0,010 Pb ≤ 0,007 Cd ≤ 0,004 Pb+Cd ≤ 0,011 Sn ≤ 0,001 Fe ≤ 0,005 Cu ≤ 0,002 other: total ≤ 0,12	1
2.2	Zn99	Zn ≥ 99	total ≤ 1,0 Pb ≤ 0,05 Cd ≤ 0,005 Pb+Cd ≤ 0,06 Sn ≤ 0,001 Fe ≤ 0,01 Cu ≤ 0,7 Mo ≤ 0,01 Ti ≤ 0,16 Mg ≤ 0,01 Al ≤ 0,01 other: total ≤ 0,12	1
2.3	ZnAl15	Zn 84 to 86 Al 14 to 16	total ≤ 0,17 Pb ≤ 0,007 Cd ≤ 0,004 Pb+Cd ≤ 0,011 Sn ≤ 0,001 Fe ≤ 0,02 Cu ≤ 0,01 Si ≤ 0,12	1
2.4	ZnAl2	Zn 97,5 to 98,5 Al 1,5 to 2,5	total ≤ 0,17 Pb ≤ 0,007 Cd ≤ 0,004 Pb+Cd ≤ 0,011 Sn ≤ 0,001 Fe ≤ 0,02 Cu ≤ 0,01 Si ≤ 0,12	1

Table 4 (continued)

Code number	Symbol	Alloying elements % (mass fraction)	Other elements % (mass fraction)	Manufacturing process
2.5	ZnAl4	Zn 95,5 to 96,5 Al 3,5 to 4,5	total ≤ 0,17 Pb ≤ 0,007 Cd ≤ 0,004 Pb+Cd ≤ 0,011 Sn ≤ 0,001 Fe ≤ 0,02 Cu ≤ 0,01 Si ≤ 0,12	1
2.6	ZnAl22	Zn 77 to 79 Al 21 to 23	total ≤ 0,17 Pb ≤ 0,007 Cd ≤ 0,004 Pb+Cd ≤ 0,011 Sn ≤ 0,001 Fe ≤ 0,05 Cu ≤ 0,01 Si ≤ 0,12	1

Table 5 — Aluminium and aluminium alloys

Code number	Symbol	Alloying elements % (mass fraction)	Other elements % (mass fraction)	Manufacturing process
3.2	Al99,5	Al ≥ 99,5	total ≤ 0,3 Si ≤ 0,25 Fe ≤ 0,40 Ti ≤ 0,02 Cu ≤ 0,02 Zn ≤ 0,07 Mn ≤ 0,02 other: particular ≤ 0,03	1
3.3	AlMg5	Mg 4,5 to 5,6 Mn 0,05 to 0,20 Cr 0,05 to 0,20 Ti 0,06 to 0,20 remainder Al	total ≤ 0,9 Si ≤ 0,30 Fe ≤ 0,40 Cu ≤ 0,10 Zn ≤ 0,10 other: particular ≤ 0,15	1
3.4	AlZn5	Zn 4,5 to 5,1 remainder Al	total ≤ 1 Si ≤ 0,30 Fe ≤ 0,40 Cu ≤ 0,05 Sn ≤ 0,20 other: particular ≤ 0,05	1

Table 5 (continued)

Code number	Symbol	Alloying elements % (mass fraction)	Other elements % (mass fraction)	Manufacturing process
3.5	AlSi5	Si 4,5 to 6,0 remainder Al	total ≤ 1 Si ≤ 0,30 Fe ≤ 0,80 Cu ≤ 0,30 Mn ≤ 0,05 Mg ≤ 0,05 Zn ≤ 0,10 Sn ≤ 0,20 other: particular ≤ 0,15	1
3.6	AlSi12	Si 11,0 to 13,0 remainder Al	total ≤ 1 Fe ≤ 0,80 Cu ≤ 0,30 Mn ≤ 0,15 Mg ≤ 0,10 Zn ≤ 0,20 Ti ≤ 0,15 other particular: ≤ 0,05 other total: ≤ 0,15	1

Table 6 — Copper and copper alloys

Code number	Symbol	Alloying elements % (mass fraction)	Other elements % (mass fraction)	Manufacturing process
4.1	Cu99	Cu ≥ 99,9	other ≤ 0,01	1
4.2	CuZn37	Cu 62,0 to 64 remainder Zn	Al ≤ 0,03 Fe ≤ 0,1 Mn ≤ 0,1 Ni ≤ 0,3 Pb ≤ 0,1 Sb ≤ 0,01 Sn ≤ 0,1 other: total ≤ 0,5	1
4.3	CuZn39	Cu 56 to 62 Sn 0,5 to 1,5 Si 0,1 to 0,5 remainder Zn	Ni ≤ 1,5 Mn ≤ 1,0 Fe ≤ 0,5 Al ≤ 0,01 Pb ≤ 0,03 other: total ≤ 0,2	1

Table 6 (continued)

Code number	Symbol	Alloying elements % (mass fraction)	Other elements % (mass fraction)	Manufacturing process
4.4	CuSn6	Sn 5,0 to 8,0 remainder Cu	Fe ≤ 0,1 Al ≤ 0,01 Zn ≤ 0,1 Pb ≤ 0,02 P 0,01 to 0,4 other: total ≤ 0,4	1
4.6	CuAl8	Al 7,5 to 9,5 remainder Cu	Mn ≤ 1,8 Ni ≤ 0,8 Fe ≤ 0,5 Si ≤ 0,2 Zn ≤ 0,2 other: total ≤ 0,5	1
4.7	CuAl10	Al 8,5 to 11 Fe 0,5 to 1,5 remainder Cu	Ni+Co ≤ 1,0 Pb ≤ 0,02 Si ≤ 0,1 Mn ≤ 0,03 Zn ≤ 0,02 other: total ≤ 0,3	1

Table 7 — Iron and iron alloys

Code number	Symbol	Alloying elements % (mass fraction)	Other elements % (mass fraction)	Manufacturing process
5.1	10Mn	C 0,04 to 0,12 Mn 0,42 to 0,68 remainder Fe	Si traces Cr ≤ 0,15 Cu ≤ 0,20 Ni ≤ 0,15 P ≤ 0,030 S ≤ 0,030	1
5.3	80MnSi	C 0,8 to 0,85 Si 0,15 to 0,35 Mn 0,50 to 0,70 remainder Fe	P ≤ 0,035 S ≤ 0,035	1
5.6	110MnCrTi5-5	C 0,97 to 1,23 Si 0,12 to 0,38 Mn 1,76 to 2,27 Cr 1,65 to 1,95 remainder Fe	Ti 0,13 to 0,35 P ≤ 0,025 S ≤ 0,025	1
5.7	X45Cr13 a) with Cu plating b) without Cu plating	C 0,3 to 0,50 Si ≤ 1,0 Mn ≤ 1,0 Cr 12 to 14 remainder Fe	P ≤ 0,045 S ≤ 0,030	1

^a Material is similar to that in brackets. Different limit values are underlined.