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Metallic powders, excluding powders for hardmetals — Determination of dimensional changes associated with compacting and sintering

Poudres métalliques à l'exclusion des poudres pour métaux-durs — Détermination de changements dimensionnels liés à la compression et au frittage

Reference number
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Foreword

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This document was prepared by Technical Committee ISO/TC 119, *Powder metallurgy*, Subcommittee SC 2, *Sampling and testing methods for powders (including powders for hardmetals)*.

This fourth edition cancels and replaces the third edition (ISO 4492:2013), of which it constitutes a minor revision to adjust tolerances and geometry in Figures 1 and 2 and clarify the use of scale and micrometer.

Metallic powders, excluding powders for hardmetals — Determination of dimensional changes associated with compacting and sintering

1 Scope

This document specifies a method by which the dimensional changes associated with compacting and sintering of metallic powders are compared with those of a reference powder when processed under similar conditions (see Clause 4).

The method applies to the determination of three types of dimensional changes involved with the processing of metallic powders, excluding powders for hardmetals.

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 2740, *Sintered metal materials, excluding hardmetals — Tensile test pieces*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

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

4 Principle

Compaction of a metallic powder or powder mix with admixed lubricant was used to produce a test piece that was sintered under controlled conditions. Depending upon the particular dimensional change required, measurement of the dimension of the uploaded die cavity, the green compact, and/or the sintered test piece is calculated. The algebraic difference between these various measurements is calculated as a percentage of the dimension of the die cavity or the green compact. (See Clause 9.)

Standard test pieces made from a reference lot of powder are processed together with the sample under test and the dimensional changes of the two powders are reported (see Annex A for additional information).

5 Test parameters

The reference powder shall be chosen by agreement between the supplier and user and shall have a composition and properties as close as possible to those of the powder to be tested.

The following three types of dimensional changes are dealt with in this document:

5.1 From die size to green size (spring back): The increase in dimensions of a compact, measured at right angles to the direction of pressing, after being ejected from the die.

5.2 From green size to sintered size (sintered dimensional change): The change in dimensions of an object that occurs as a result of sintering.

5.3 From die size to sintered size (total dimensional change).

6 Symbols and designations

Symbol	Designation	Unit
d_D	Test dimension of unloaded die	mm
d_G	Test dimension of green compact	mm
d_S	Test dimension of sintered compact	mm
Δd_{DG}	Spring back	% (+)
Δd_{GS}	Sintered dimensional change	% (+ or −)
Δd_{DS}	Total dimensional change	% (+ or −)

7 Apparatus

7.1 Tools set, that will produce cylindrical (see Figure 1), rectangular (see Figure 2) or tensile test pieces (in accordance with ISO 2740), or test pieces similar to the actual components for which the powder is required.

7.2 Press, capable of applying the pressures necessary to achieve the required density or required compacting pressure. See Figure 3.

7.3 Scale, capable of weighing at least 100 g and readable to 0,001 g.

7.4 Micrometer, or other suitable measuring device readable to 0,005 mm for measuring the dimensions of the compacts and the die.

7.5 Sintering furnace, capable of producing sintering conditions (time-temperature curve and atmosphere) as close as possible to those used in industry for the type of material to be tested.

8 Sampling

Representative quantities of both the test and the reference powders sufficient to give at least three compacts shall be taken.

9 Procedure

9.1 The test powder and the reference powder shall be mixed under the same conditions with the same mass of additives, including lubricant, each taken from the same batch, to produce the composition of the sintered components for which the powder is required.

A test powder supplied ready for pressing shall be tested in the as-received condition.

To avoid the possibility of distortion during sintering, it is recommended that the test pieces should not be less than 5 mm thick.

9.2 Measure, to the nearest 0,005 mm, the test dimension (diameter or length) of the die in the unloaded condition and record the value d_D obtained.

