
**Fine ceramics (advanced ceramics,
advanced technical ceramics) —
Determination of compaction
properties of ceramic powders**

*Céramiques techniques — Détermination des propriétés de
compactage des poudres céramiques*

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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.

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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 206, *Fine ceramics*.

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Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of compaction properties of ceramic powders

1 Scope

This International Standard specifies the test method to determine the extent to which granulated or ungranulated ceramic powders are compacted, when subjected to uniaxial compressive loading in a confining die, under specified conditions.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Principle

Granulated or ungranulated ceramic powders are compacted uniaxially in a confining die by double-action pressing (mode 1) or by single-action pressing (mode 2). Samples of the ceramic powders can be pressed either at a single specified pressure or at a series of specified pressures. After ejection from die, the apparent density of the ceramic powder compact is determined.

The apparent density obtained in the former case represents the compaction properties of the ceramic powder at the specified pressure. The apparent densities obtained in the latter case are utilized for drawing the compaction curve of the ceramic powder, which is a plot of apparent density as a function of compaction pressure.

4 Symbols and designation

Symbol	Designation	Unit
ρ_a	Apparent density	g/cm ³
m	Mass of ceramic powder compact	g
V	Volume of ceramic powder compact	cm ³

If the apparent density is measured at only one specified pressure, for example 100 MPa, the symbol becomes $\rho_a(100)$.

5 Apparatus

5.1 Cylindrical die, should be made from hard material, preferably hardened steel or tungsten carbide.

The die shall contain two upper and lower punches for producing cylindrical powder compacts and shall be of the floating type or of the type suspended from a spring (mode 1), or of stationary type with only one movable upper punch (mode 2). The die shall be capable of making cylindrical powder compacts with a diameter from 10 mm to 26 mm and a height to diameter ratio between 0,3 and 0,5 (mode 1), or with a diameter from 10 mm to 32 mm and a height to diameter ratio between 0,15 and 0,25 (mode 2).

2), as indicated in [Figure 1](#). The upper part of the die shall be preferably designed to avoid damage to the powder compact during ejection due to spring-back. An ejection cone of height 5 mm, allowing an increase of the diameter at the top of the die of approximately 1 %, as shown in [Figure 1](#), should be used.

5.2 Press, capable of applying sufficient force with a precision of ± 2 %.

5.3 Balance, capable of weighing at least 10 g with a resolution of $\pm 0,001$ g.

5.4 Micrometer, or other suitable measuring device for measuring the dimensions of ceramic powder compacts with a resolution of $\pm 0,01$ mm.

6 Sampling

6.1 In general, the powder should be tested in the as-received condition. In certain instances, the powder can be dried. If the powder is required to be dried, it should be dried at $(110 \pm 5)^\circ\text{C}$ for at least 24 h and cooled to room temperature in a desiccator until the test is performed. If the powder contains organic additives or volatile substances, it should not be dried.

6.2 Should there be any treatment (e.g. drying) of the powder before the test, it shall be recorded in the test report.

7 Procedure

7.1 Quantity

The quantity of the test sample shall be chosen to give the required number of powder compacts with dimensions as specified in [5.1](#). Per compaction pressure, three powder compacts shall be pressed (see [7.6](#)). If necessary, preliminary tests should be made in order to establish the quantity of powder which is needed for fulfilling this requirement.

7.2 Cleaning of die and punches

Wipe the die cavity and the punches, for example, with a soft clean paper towel soaked with an appropriate solvent such as acetone. Allow the solvent to evaporate.

7.3 Powder testing conditions

7.3.1 Powders which do not contain a lubricant shall be compacted either

a) in a dry die,

NOTE Seizure and excessive die wear can occur, particularly, at high compaction pressures.

b) in a die with lubricated walls (see [7.4.2](#)),

c) in a dry die, after mixing a lubricant with the powder (see [7.4.3](#)), and

d) in the as-received state.

7.3.2 Powders which contain a lubricant shall be compacted in a dry die.