

**SLOVENSKI STANDARD**  
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**Metalurgija prahov - Slovar (ISO/DIS 3252:2018)**

Powder metallurgy - Vocabulary (ISO/DIS 3252:2018)

Pulvermetallurgie - Begriffe (ISO/DIS 3252:2018)

Métallurgie des poudres - Vocabulaire (ISO/DIS 3252:2018)

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## Powder metallurgy — Vocabulary

*Métallurgie des poudres — Vocabulaire*

ICS: 77.160; 01.040.77

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# Contents

	Page
<b>Foreword</b> .....	<b>iv</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
3.1 Terms for powders .....	1
3.2 Terms for forming .....	8
3.3 Terms for sintering .....	14
3.4 Terms for post-sintering treatments .....	19
3.5 Terms for powder metallurgy materials .....	20
<b>Bibliography</b> .....	<b>28</b>

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## ISO/DIS 3252:2018(E)

## Foreword

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This document was prepared by Technical Committee ISO/TC 119, *Powder metallurgy*.

This fifth edition, which cancels and replaces the fourth edition (ISO 3252:1999), which has been updated by the addition of additional terms in current use.

# Powder metallurgy — Vocabulary

## 1 Scope

This document defines terms relating to powder metallurgy. Powder metallurgy is the branch of metallurgy which relates to the manufacture of metallic powders, or of articles made from such powders with or without the addition of non-metallic powders, by the application of forming and sintering processes.

The terms are classified alphabetically under the following main headings:

- 1 Powders
- 2 Forming
- 3 Sintering
- 4 Post-sintering treatments
- 5 Powder metallurgy materials

NOTE Additional information on certain of the terms defined can be found in the standards given in parentheses at the end of certain definitions. These are listed in the Bibliography.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

### 3.1 Terms for powders

#### 3.1.1

##### **acicular**

needle-shaped ([Figure 1](#))

#### 3.1.2

##### **angle of repose**

basal angle of a pile formed by a powder when freely poured under specified conditions on to a horizontal surface

#### 3.1.3

##### **apparent density**

mass per unit volume of a powder obtained follow specific methods (e.g. ISO 3923-1 and ISO 3923-2 for free-flowing powders)

#### 3.1.4

##### **agglomerate**

several particles adhering together ([Figure 2](#))

## ISO/DIS 3252:2018(E)

## 3.1.5

**alloyed powder**

metal powder consisting of at least two constituents that are partially or completely alloyed with each other

## 3.1.6

**angular**

sharp-edged or roughly polyhedral (Figure 3)

## 3.1.7

**atomized metal powder**

metal powder produced by disintegration of molten metals or alloys into droplets which are allowed to solidify into individual particles

Note 1 to entry: The medium of disintegration is usually a rapidly moving gas or liquid stream.

## 3.1.8

**binder**

cementing medium; either a material added to the powder to increase the green strength of the compact, and which is expelled during sintering; or a material (usually of lower melting point) added to a powder mixture for the specific purpose of cementing together powder particles which alone would not sinter into a strong body

## 3.1.9

**blended powder**

powder made by blending powders of the same nominal composition

## 3.1.10

**blending**

thorough intermingling of powders of the same nominal composition (not to be confused with *mixing*, 3.1.51)

## 3.1.11

**bulk density**

mass per unit volume of a powder under nonstandard conditions

## 3.1.12

**bridging**

formation of arched cavities in a powder mass

## 3.1.13

**cake**

bonded mass of unpressed metal powder

## 3.1.14

**carbonyl powder**

powder produced by the thermal decomposition of a metal carbonyl

## 3.1.15

**chill-block cooling**

process for producing rapidly solidified powders by cooling a thin layer of molten material on a solid substrate

## 3.1.16

**chopped powder**

powder produced by chopping material such as sheet, ribbon, fibre or filament

## 3.1.17

**classification**

separation of powder into fractions according to particle size



**3.1.18****comminuted powder**

powder produced by mechanical disintegration of solid metal

**3.1.19****compactability**

conceptual term, encompassing the powder characteristics of compressibility, green strength, edge retention, and lamination tendency, that relates to the ability of a powder to be consolidated into a usable green compact

Note 1 to entry: Compactability may be a function of flowability, compressibility and green strength.

**3.1.20****completely alloyed powder**

alloyed powder in which each powder particle has a homogeneous chemical composition being that of the entire powder

**3.1.21****compression ratio**

ratio of the volume of the loose powder to the volume of the compact made from it

**3.1.22****coated powder**

powder consisting of particles having a surface layer of different composition

**3.1.23****composite powder**

powder in which each particle consists of two or more different constituents

**3.1.24****compressibility**

capacity of a powder to be densified under an uniaxially applied pressure (ISO 3927)

Note 1 to entry: The pressure applied is usually a uniaxial pressure in a closed die. Compressibility may be expressed as the pressure needed to reach a required density or as the density obtained at a given pressure.

**3.1.25****cut**

fraction of a powder nominally within stated particle size limits

**3.1.26****dehydrided powder**

powder made by removal of hydrogen from metal hydride

**3.1.27****dendritic**

of branched shape (Figure 4)

**3.1.28****diffusion-alloyed powder**

partially alloyed powder produced by means of a thermal process

**3.1.29****dopant**

substance added in small quantity to a metallic powder to prevent or control recrystallization or grain growth either during sintering or during use of the resultant sintered object

Note 1 to entry: This term is especially used in the powder metallurgy of tungsten.

**3.1.30****electrolytic powder**

powder produced by an electrolytic process

## ISO/DIS 3252:2018(E)

**3.1.31****elutriation**

classification of a powder through movement of the particles through a fluid medium

EXAMPLE Air classification and liquid classification.

**3.1.32****feedstock**

moldable mixture of metal powder and binder used for injection moulding or powder extrusion

**3.1.33****fibrous**

having the appearance of regularly or irregularly shaped threads (Figure 5)

**3.1.34****fill factor**

in uniaxial pressing, the ratio of the height to which a powder fills a die to the height of the compact, measured after ejection from the die

**3.1.35****fines**

fraction of a powder that passes through the smallest sieve size used in the sieve analysis

**3.1.36****flaky****flaked**

platelike (Figure 6)

**3.1.37****flowability**

qualitative term describing the behaviour of a powder when flowing through an opening (ISO 4490)

**3.1.38****flowmeter**

standardized funnel and cylindrical cup used for the determination of *apparent density* (3.1.3 and ISO 3923-1 and ISO 3923-2) and *flow time* (3.1.39 and ISO 4490)

**3.1.39****flow time**

time required for a standard quantity of powder to flow through a standard orifice under specified conditions (ISO 4490)

**3.1.40****granular**

approximately equidimensional nonspherical shape (Figure 7)

**3.1.41****granulation**

agglomeration of fine particles to obtain a coarser powder with improved flowability

**3.1.42****hydrogen loss**

loss in weight of metal powder or of a compact caused by heating a representative sample for a specified time and temperature in a purified hydrogen atmosphere—broadly, a measure of the oxygen content of the sample when applied to materials containing only such oxides as are reducible with hydrogen and no hydride forming element (ISO 4491-2)

**3.1.43****hydrogen-reducible oxygen**

oxygen content of a powder emanating from oxygen-bearing constituents reduced by hydrogen under standardized conditions (ISO 4491-3)

**3.1.44****irregular**

lacking any symmetry (Figure 8)

**3.1.45****lubricant**

material used to reduce inter-particle friction and the friction between the powder mass and the tooling

**3.1.46****master alloy powder**

alloyed powder containing a relatively high concentration of one or more elements that may be difficult to introduce in their unalloyed states

Note 1 to entry: The master alloy powder is mixed with other powders to produce the required final composition.

**3.1.47****mechanical alloying**

process of alloying in the solid state by high-energy attritor or ball-mill

**3.1.48****mechanically alloyed powder**

composite powder produced by mechanically incorporating other constituents which are generally insoluble within the deformable particles of the matrix metal

**3.1.49****milling**

mechanical treatment of metal powder, or metal powder mixtures, as in a ball mill, to alter the size or shape of the individual particles or to coat one component of the mixture with another

**3.1.50****mixed powder**

powder made by mixing powders, the constituent powders differing in composition

**3.1.51****mixing**

thorough intermingling of powders of two or more materials

**3.1.52****nodular**

of rounded irregular shape (Figure 9)

**3.1.53****oversize**

fraction of a powder sample with particle size larger than any specified upper limit

**3.1.54****oversize particle**

particle larger than any specified upper limit

**3.1.55****partially alloyed powder**

alloyed powder, the particles of which have not reached the completely alloyed state

**3.1.56****particle**

unit of powder that cannot readily be subdivided by the usual separation processes ([Figure 1](#))

Note 1 to entry: The term “grain” is not synonymous with “particle” and should be used in its normal metallurgical sense.

## ISO/DIS 3252:2018(E)

**3.1.57****particle size**

linear dimension of an individual particle as determined by analysis with sieves or other suitable means

**3.1.58****particle size distribution**

percentage by mass, by numbers or by volume, of each fraction into which a powder sample has been classified with respect to size (ISO 4497)

**3.1.59****particle shape**

external geometric form of a powder particle

**3.1.60****plasticizer**

thermoplastic material used as a binder for improving formability of powders

**3.1.61****powder**

particles that are usually less than 1 mm in size

**3.1.62****pre-alloyed powder**

completely alloyed powder usually made by atomization of melt ([3.1.7](#))

**3.1.63****precipitated powder**

powder produced by chemical precipitation from solution

**3.1.64****press-ready mix****premix**

mixture of powders with other ingredients designed to make the mixture ready for compaction

**3.1.65****rapidly solidified powder**

powder produced directly or in-directly at high solidification rates such that the particles have a modified or metastable microstructure

**3.1.66****reaction milling**

process of mechanical alloying in which a reaction takes place between the metal and additives, the atmosphere or both

**3.1.67****reduced powder**

powder produced by chemical reduction of a metal compound without melting

**3.1.68****sample splitter**

device by means of which a previously obtained powder sample is split into representative portions (ISO 3954)

**3.1.69****sample thief**

device used to draw a representative powder sample from a bulk quantity of powder (ISO 3954)

**3.1.70****sedimentation**

settling of particles, suspended in a liquid, through the influence of an external force, such as gravity or centrifugal force