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Powder metallurgy—Vocabulary

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of International Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law. Consequently **JIS Z 2500 : 1987** is replaced with **JIS Z 2500 : 2000**.

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Powder metallurgy—Vocabulary

Introduction This Japanese Industrial Standard has been prepared based on **ISO/DIS 3250 Powder metallurgy—Vocabulary** published as the third edition in 1998.

“Terms” with dotted underlines in this Standard are the terms not existing in the original International Standard.

1 Scope This Standard specifies definitions of the terms concerning powder metallurgy⁽¹⁾. The powder metallurgy is the metallurgical part for manufacture of metal powder or manufacture of a product by forming and sintering process from the metal powder, and it does not matter whether non-metallic powder is added or not. The products include those manufactured by combination of metal and non-metallic powder.

Note ⁽¹⁾ PM and P/M are often used as the abbreviated forms of “Powder Metallurgy” and “PM part”, “P/M product” or “PM method” is expressed.

Remarks : International Standard corresponding to this Standard is as follows.

ISO/DIS 3252 : 1998 *Powder metallurgy—Vocabulary*

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards indicated below shall be applied.

JIS Z 2501 *Sintered metal materials—Determination of density, oil content, and open porosity*

JIS Z 2502 *Metallic powders—Determination of flowability by means of a calibrated funnel (Hall flowmeter)*

JIS Z 2503 *Powders for powder metallurgical purposes—Sampling*

JIS Z 2504 *Metallic powders—Determination of apparent density—Funnel method*

JIS Z 2507 *Sintered metal bearing—Determination of radial crushing strength*

3 Classification of terms Terms are classified in the following items.

- a) Powders
- b) Forming
- c) Sintering
- d) Post-sintering treatments (post-treatment)
- e) Powder metallurgy materials

4 Terms and definitions

a) Powders

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
1001	粉末	HUNMATU	Assembly of discrete particles usually less than 1 mm in size.	powder
1002	粒子	RYŪSI	Unit of powder that cannot readily be subdivided by the usual separation processes (see Attached Fig. 1). Remarks : The term "grain" is not synonymous with "particle" and should be used in its normal metallurgical sense.	particle
1003	凝集粉	GYŌSYŪHUN	Several particles adhering together (see Attached Fig. 1).	agglomerate
1004	スラリー	SURARI	Pourable viscous dispersion of powder in a liquid.	slurry
1005	ケーキ	KÊKI	Coalesced mass of unpressed metal powder.	cake
1006	フィードストック	FĪDOSUTOKKU	Plasticized powder used as raw material for injection molding or powder extrusion.	feedstock

1) Classification of powder

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
1101	金属粉	KINZOKUHUN	Powder of metal. In a wide sense, alloyed powder is included.	metal powder
1102	アトマイズ粉	ATOMAIZUHUN	Powder produced by disintegration of molten metals into droplets which are allowed to solidify into individual particles. Remarks : The medium of disintegration is usually a rapidly moving gas or liquid stream.	atomized powder
1103	カーボニル粉	KÂBONIRUHUN	Powder produced by the thermal decomposition of a metal carbonyl.	carbonyl powder
1104	粉砕粉	HUNSAIHUN	Powder prepared by pulverization.	comminuted powder, pulverized powder

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
1105	電解粉	DENKAIHUN	Powder prepared by electrolytic deposition.	electrolytic powder
1106	沈殿粉	TINDENHUN	Powder produced by chemical precipitation from solution.	precipitated powder
1107	還元粉	KANGENHUN	Powder produced by chemical reduction from metal compound.	reduced powder
1108	海綿状粉	KAIMENZYÔHUN	Porous, reduced powder produced by comminution of a metal sponge which is in itself a coherent, highly porous metal.	sponge powder
1109	合金粉	GÔKINHUN	Powder consisting of particles of alloyed composition.	alloyed powder
1110	完全合金粉	KANZEN GÔKINHUN	Alloyed powder in which each powder particle has the same homogeneous chemical composition being that of the entire powder.	completely alloyed powder
1111	ブレアロイ粉	PUREAROIHUN	Completely alloyed powder usually made by atomization of molten metal.	pre-alloyed powder
1112	部分合金化粉	BUBUN GÔKINKAHUN	Alloyed powder, the particles of which have not reached the completely alloyed state.	partially alloyed powder
1113	拡散合金粉	KAKUSAN GÔKINHUN	Partially alloyed powder produced by a thermal diffusion process.	diffusion-alloyed powder
1114	メカニカルアロイ粉	MEKANIKARU AROIHUN	Composite powder produced by mechanically incorporating other constituents which are generally insoluble with the deformable particles of the matrix metal.	mechanically alloyed powder
1115	母合金粉	BOGÔKINHUN	Alloy powder containing a relatively high concentration of one or more elements, which is mixed together with other powder to obtain a required final composition.	master alloy powder
1116	複合粉	HUKUGÔHUN	Powder in which each particle consists of two or more different constituents.	composite powder
1117	被覆粉	HIHUKUHUN	Powder consisting of particles having a surface layer of different composition.	coated powder
1118	ブレンド粉	BURENDOHUN	Powder made by blending powders of the same nominal composition.	blended powder
1119	混合粉	KONGÔHUN	Powder made by mixing powders, the constituent powders differing in composition.	mixed powder

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
1120	ブレミックス粉	PUREMIKKUSUHUN	Mixed powder designed so as to be capable of being formed as it is.	press-ready mix, pre-mix, pre-mixed powder
1121	脱水素粉	DATUSUISOHUN	Powder obtained by removing hydrogen from metal hydride.	dehydrated powder
1122	急冷凝固粉	KYŪREI GYŌKOHUN	Powder produced directly or indirectly at high solidification rates such that the particles have a modified or metastable microstructure.	rapidly solidified powder
1123	チップ粉	TIPPUHUN	Powder produced by chopping material such as sheet, ribbon, fiber or filament.	chopped powder
1124	超音波ガスアトマイズ粉	TYŌONPA GASU ATOMAIZUHUN	Powder produced by a gas atomization process in which ultrasonic vibration is applied to the gas jet.	ultrasonically gas- atomized powder

2) Powder additives

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
1201	結合剤	KETUGŌZAI	Substance added to prevent separation or dispersion of a powder to increase strength of a compact or to add plasticity to the powder. The binder is removed before sintering or in sintering.	binder
1202	ドーパ剤	DŌPUZAI	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. Remarks: This term is especially used in the powder metallurgy of tungsten.	dope, dopant
1203	潤滑剤	ZYUNKATUZAI	Substance added to a powder to reduce the friction between particles and between the compact and the tool surfaces.	lubricant
1204	可塑剤	KASOZAI	Thermoplastic material used as a binder for improving formability of powders.	plasticizer

3) Manufacture of powder and its treatment

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
1301	粉碎	HUNSAI	Operation in which raw material is pulverized to make powder by a mechanical means.	pulverization
1302	スタンピング	SUTANPINGU	Operation in which pulverization is performed by impact of a dropping pestle.	stamping
1303	噴霧	HUNMU	Operation in which molten metal is made into powder by dispersion and solidification.	atomization
1304	超音波ガスアトマイズ	TYŌONPA GASU ATOMAIZU	Atomization process in which ultrasonic vibration is applied to the gas jet.	ultrasonic gas-atomizing
1305	冷却ブロック法	REIKYAKU BUROKKUHŌ	Process for producing rapidly solidified powders by dropping and cooling a thin layer of molten material on a solid substance.	chill-block cooling
1306	反応ミリング法	HANNŌ MIRINGUHŌ	Process of mechanical alloying in which a reaction takes place between the metal and additives or the atmosphere or both.	reaction milling
1307	メカニカルアロイ法	MEKANIKARU AROIHŌ	Process of alloying in the solid state by high-energy attritor or ball-mill.	mechanical alloying
1308	ブレンディング	BURENDINGU	Thorough intermingling of powders of the same nominal composition.	blending
1309	混合	KONGŌ	Thorough intermingling of powders of two or more different compositions or powder and other materials.	mixing
1310	ミリング	MIRINGU	General term for mechanical treatment of powder, resulting in, for example: 1 modification of particle size or shape (comminution, agglomeration, etc.); 2 intimate mixing; 3 coating of the particles of one constituent with another constituent.	milling
1311	造粒	ZŌRYŪ	Agglomeration of fine particles to obtain a coarser powder with improved flowability.	granulation

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
1312	スプレードライ	SUPURÉ-DORAI	Process for granulating powders by the rapid evaporation of the liquid from the droplets of a slurry.	spray drying

4) Powder particle shapes

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
1401	粒形	RYŪKEI	External geometric form of a powder particle.	particle shape
1402	針状	SINZYŌ	Needle-shaped (see Attached Fig. 2).	acicular
1403	角状	KAKUZYŌ	Sharp-edged or roughly polyhedral (see Attached Fig. 3).	angular
1404	樹枝状	ZYUSIZYŌ	Of branched shape (see Attached Fig. 4).	dendritic
1405	纖維状	SEN'IZYŌ	Having the appearance of regularly or irregularly shaped threads (see Attached Fig. 5).	fibrous
1406	片状	HENZYŌ	Flaked, platelike (see Attached Fig. 6).	flaky, flaked
1407	粒状	RYŪZYŌ	Approximately equidimensional but of irregular shape (see Attached Fig. 7).	granular
1408	不規則形状	HUKISOKU-KEIZYŌ	Lacking any symmetry (see Attached Fig. 8).	irregular
1409	滴状	RUTEKIZYŌ	Of rounded irregular shape (see Attached Fig. 9).	nodular
1410	球状	KYŪZYŌ	Roughly spherical (see Attached Fig. 10).	spheroidal

5) Powder properties, test procedures, test equipment and results

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
1501	安息角	ANSOKUKAKU	Basal angle of a pile formed by a powder when freely poured on to a horizontal surface.	angle of repose
1502	見掛密度	MIKAKE MITUDO	Mass of powder per unit volume obtained under determined conditions. (See JIS Z 2501.)	apparent density
1503	バルク密度	BARUKU MITUDO	Mass per unit volume of a powder under non-specified conditions.	bulk density
1504	タップ密度	TAPPU MITUDO	Mass of powder per unit volume which has been kept in a vibrating container.	tap density
1505	圧縮性	ASSYUKUSEI	Capacity of a powder to be densified under an applied pressure. 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.	compressibility
1506	成形性	SEIKEISEI	Ability of a powder to be pressed into a shape which maintains its integrity during subsequent processing. Compactibility may be a function of flowability, compressibility and green strength.	compactibility
1507	ラトル値	RATORATI	Edge strength of a compact, expressed as the loss of the mass, measured after dropping the green compact repeatedly in a rotating basket.	rattler value
1508	圧縮比	ASSYUKUHI	Value obtained by dividing the volume of a filled powder by the volume of green compact.	compression ratio
1509	充てん比	ZYŪTENHI	Value obtained by dividing the height of a filled powder by the height of green compact.	fill factor
1510	流動性	RYŪDŌSEI	Qualitative term describing the behaviour of a powder when flowing through an opening. (See JIS Z 2502.)	flowability
1511	流動時間	RYŪDŌ ZIKAN	Time required for a standard quantity of powder to flow through a standard orifice under specified conditions. (See JIS Z 2502.)	flow time, flow rate

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
1512	還元減量	KANGENGENRYŌ	Percentage of loss in mass when a powder or a green compact is heated in a hydrogen stream.	hydrogen loss
1513	酸素量(水素還元による)	SANSORYŌ (SANSO KANGEN NI YORU)	Oxygen content of a powder emanating from oxygen-bearing constituents reduced by hydrogen under standardized conditions.	hydrogen-reducible oxygen
1514	偏析	HENSEKI	Undesirable separation of one or more constituents of a powder mixture.	segregation, demixing
1515	粒径	RYŪKEI	Dimension of an individual particle. It is expressed with a diameter for a spherical particle, but in the case of a nonspherical particle, a measuring method is individually specified and measured values vary according to the method. It is also called RYŪSIKEI in Japanese.	particle diameter
1516	平均粒径	HEIKINRYŪKEI	Particle diameter representing that of a group of particles composed of a lot of different-sized particles.	mean particle diameter
1517	比表面積	HIHYŌMENSEKI	Total surface area of particles per unit mass of powder.	specific surface area
1518	分級	BUNKYŪ	To separate a powder into grades according to particle size.	classification
1519	粒度	RYŪDO	Linear dimension of an individual particle as determined by analysis with sieves or other suitable means.	particle size
1520	粒度分布	RYŪDOBUNPU	Percentage by mass, by numbers or by volume, of each fraction into which a powder sample has been classified with respect to size.	particle size distribution
1521	流体分級	RYŪTAIBUNKYŪ	Classification of a powder through movement of the particles through a fluid medium. Examples : Air classification and liquid classification.	elutriation
1522	空気分級	KŪKIBUNKYŪ	Classification utilizing air current.	air classification
1523	分級物	BUNKYŪBUTU	Individual part of a powder subjected to classification.	cut, fraction

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
1524	ふるい分析	HURUI BUNSEKI	Determination of particle size distribution by sieving.	sieve analysis, sieve classification, screen analysis, screen classification
1525	沈降	TINKÔ	Settling of particles, suspended in a liquid, through the influence of an external force, such as gravity or centrifugal force.	sedimentation
1526	試料採取器	SIRYÔ NUKITORI KI	Device used to draw a representative powder sample from a bulk quantity of powder. (See JIS Z 2503.)	sample thief
1527	試料分離器	SIRYÔ BUNRI KI	Device for splitting the previously obtained sample without changing its characteristics. (See JIS Z 2503.)	sample splitter
1528	ふるいセット	HURUI SETTO	Calibrated series of non-magnetic wire-cloth sieves.	sieve set
1529	流動計	RYÛDÔ KEI	Standardized funnel and cylindrical cup used for the determination of apparent density and flow time. (See JIS Z 2504 and JIS Z 2502.)	flowmeter
1530	タッピング装置	TAPPINGU SÔ TI	Device for the determination of tap density.	tapping apparatus
1531	オーバサイズ	ÔBASAI ZU	Fraction of a powder sample with particle size larger than any specified upper limit.	oversize
1532	アンダサイズ	ANDASAI ZU	Fraction of a powder sample with particle size smaller than any specified lower limit.	undersize
1533	微粉	BIHUN	Fraction of a powder that passes through the smallest sieve size used in the sieve analysis. It is also called a sub-sieve powder.	fine powder, fines
1534	超微粉	TYÔBIHUN	Powder comprised of particles of 1 µm or finer in size.	ultra fine powder
1535	オーバーサイズ粒子	ÔBASAI ZU RYÛ SI	Particle larger than any specified upper limit.	oversize particle

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
1536	アンダサイズ粒子	ANDASAIZU RYŪSI	Particle smaller than any specified lower limit.	undersize particle

b) Forming

No.	Term (Japanese character)	Reading	Definition	English equivalent (informative)
2001	フォーミング	FŌMINGU	General term for an operation wherein specific shape and dimensions are given to a powder.	forming
2002	緻密化	TIMITUKA	Process in which a powder or compact is densified.	consolidation, densification
2003	成形	SEIKEI	To produce a compact of prescribed shape and dimensions by compressing a powder.	pressing, compacting
2004	圧粉体	APPUNTAI	An as-pressed object prepared from powder.	compact, green, green compact
2005	ブランク	BURANKU	Green compact, presintered compact or sintered compact before the final processing.	blank
2006	複合圧粉体	HUKUGŌ APPUNTAI	Metal powder compact consisting of two or more adhering layers of different metals or alloys.	composite compact, compound compact
2007	プリフォーム	PURIFŌMU	Blank intended to be subject to deformation and densification involving change of shape. It is also called PUREFŌMU.	preform
2008	スケルトン	SUKERUTON	Compact or sintered object intended for infiltration.	skeleton