

CPC COOPERATIVE PATENT CLASSIFICATION

B PERFORMING OPERATIONS; TRANSPORTING

(NOTES omitted)

SHAPING

B22 CASTING; POWDER METALLURGY

B22F WORKING METALLIC POWDER; MANUFACTURE OF ARTICLES FROM METALLIC POWDER; MAKING METALLIC POWDER (processes or devices for granulating materials in general [B01J 2/00](#); making ceramics by compacting or sintering [C04B](#), e.g. [C04B 35/64](#); for the production of metals as such, see class [C22](#); reduction or decomposition of metal compounds in general [C22B](#); making alloys by powder metallurgy [C22C](#); electrolytic production of metal powder [C25C 5/00](#))

NOTES

1. This subclass covers the making of metallic powder only insofar as powder with specific physical characteristics is made;
2. In this subclass, the following terms or expressions are used with the meanings indicated:
 - "metallic powder" covers powders containing a substantial proportion of non-metallic material;
 - "powder" includes somewhat larger particles which are worked, obtained or behave in a manner similar to powder, e.g. fibres.

WARNINGS

1. The following IPC groups are not in the CPC scheme. The subject matter for these IPC groups is classified in the following CPC groups:

B22F 3/035	covered by	B22F 3/03
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2. In this subclass non-limiting references (in the sense of paragraph 39 of the Guide to the IPC) may still be displayed in the scheme.

1/00	Special treatment of metallic powder, e.g. to facilitate working, to improve properties {(treatment of powder by mechanical means, e.g. by grinding, milling, rolling B22F 9/04); Metallic powders per se, e.g. mixtures of particles of different composition (C04 , C08 take precedence; {amorphous powder B22F 9/002)}	1/0055	. . . {Flake form powders}
		1/0059	. . {Metallic powders mixed with a lubricating or binding agent or organic material}
		1/0062	. . . {Powders coated with organic material}
		2001/0066	. . . {Organic binder comprising a mixture or obtained by reaction of more than one component other than solvent, lubricant}
1/0003	. {Metallic powders <u>per se</u> ; Mixtures of metallic powders; Metallic powders mixed with a lubricating or binding agent (making ferrous alloys using a mixture of prealloyed powders C22C 33/0207)}	1/007	. . . {Non-organic or metal salt binders or lubricants}
1/0007	. . {Metallic powder characterised by its shape or structure, e.g. fibre structure}	1/0074	. . . {Organic materials comprising a solvent, e.g. for slip casting}
1/0011	. . . {Metallic powder characterised by size or surface area only}	1/0077	. . . {Mixtures obtained by warm mixing}
1/0014	. . . . {by size mixtures or distribution}	1/0081	. {Special treatment of metallic powder, e.g. to facilitate working, to improve properties (coating with organic material B22F 1/0062)}
1/0018	. . . . {Nanometer sized particles}	1/0085	. . {Thermal or thermo-mechanical treatment}
1/0022	. . . . . {Dispersions or suspensions thereof}	1/0088	. . {Chemical treatment, e.g. passivation}
1/0025	. . . . . {Nanofibres or nanotubes}	2001/0092	. . . {Making a dispersion}
2001/0029	. . . . . {Hollow particles, including tubes and shells}	1/0096	. . {Treatment resulting in the production of agglomerates}
2001/0033	. . . . . {Flake form nanoparticles}	1/02	. comprising coating of the powder {(coating with organic material B22F 1/0062 ; chemical surface treatment B22F 1/0088)}
2001/0037	. . . . . {Complex form nanoparticles, e.g.. prism, pyramid, octahedron}	1/025	. . {Metallic coating}
1/004	. . . {Fibre structure (B22F 1/0025 takes precedence)}	3/00	Manufacture of workpieces or articles from metallic powder characterised by the manner of compacting or sintering; Apparatus specially adapted therefor {; Presses and furnaces}
1/0044	. . . {Nanometer size structures}		
1/0048	. . . {Spherical powder}		
1/0051	. . . . {Hollow particles}		

3/001	. {Starting from powder comprising reducible metal compounds (making ferrous alloys starting from compounds C22C 33/0235)}	3/1055	. . . {Selective sintering, i.e. stereolithography (selective sintering of powdered plastics B29C 64/153)}
3/002	. {Manufacture of articles essentially made from metallic fibres}	2003/1056	. . . {Apparatus components, details or accessories}
3/003	. {Apparatus, e.g. furnaces (in general F27B)}	2003/1057	. . . . {for control or data processing, e.g. algorithms}
3/004	. {Filling molds with powder (feeding material to presses in general B30B 15/302)}	2003/1058	. . . . {Support structures for the 3D object during manufacturing, e.g. using sacrificial material}
3/005	. {Loading or unloading powder metal objects (transport in general B65G)}	2003/1059	. . . . {for cleaning or recycling}
3/006	. {Amorphous articles}	3/11	. . Making porous workpieces or articles
3/007	. . {by diffusion starting from non-amorphous articles prepared by powder metallurgy}	3/1103	. . . {with particular physical characteristics}
3/008	. {Selective deposition modelling (B22F 3/1055 takes precedence)}	2003/1106	. . . . {Product comprising closed porosity}
3/02	. Compacting only	3/1109	. . . . {Inhomogenous pore distribution (composite layers of porous nature B22F 7/002)}
2003/023	. . {Lubricant mixed with the metal powder}	3/1112	. . . . {comprising hollow spheres or hollow fibres}
2003/026	. . {Mold wall lubrication or article surface lubrication}	3/1115	. . . . {comprising complex forms, e.g. honeycombs}
3/03	. . Press-moulding apparatus therefor	3/1118	. . . . {comprising internal reinforcements}
2003/031	. . . {with punches moving in different directions in different planes}	3/1121	. . . {by using decomposable, meltable or sublimatable fillers}
2003/033	. . . {with multiple punches working in the same direction}	3/1125	. . . . {involving a foaming process}
3/04	. . by applying fluid pressure {, e.g. by cold isostatic pressing [CIP]}	2003/1128	. . . . {Foaming by expansion of dissolved gas, other than with foaming agent}
3/045	. . . {Semi-isostatic pressure}	2003/1131	. . . . {Foaming in a liquid suspension and decomposition}
3/06	. . by centrifugal forces	3/1134	. . . . {Inorganic fillers (carbonaceous or paper filler B22F 3/1121)}
3/08	. . by explosive forces {(generating shock waves in general G10K 15/043)}	3/1137	. . . . {by coating porous removable preforms}
3/087	. . using high energy impulses, e.g. magnetic field impulses	3/114	. . . {the porous products being formed by impregnation (B22F 3/1137 , B22F 3/26 take precedence)}
3/093	. . using vibrations {or friction}	3/1143	. . . {involving an oxidation, reduction or reaction step}
3/10	. Sintering only	3/1146	. . . {After-treatment maintaining the porosity (B22F 3/114 takes precedence)}
3/1003	. . {Use of special medium during sintering, e.g. sintering aid}	3/115	. by spraying molten metal, i.e. spray sintering, spray casting
3/1007	. . . {Atmosphere (B22F 3/1021 takes precedence)}	3/12	. Both compacting and sintering (by forging B22F 3/17)
3/101	. . . . {Changing atmosphere}	3/1208	. . {Containers or coating used therefor}
2003/1014	. . . {Getter}	3/1216	. . . {Container composition}
3/1017	. . {Multiple heating or additional steps (B22F 3/101 takes precedence)}	3/1225	. . . . {Glass}
3/1021	. . . {Removal of binder or filler (removal of binder from ceramics C04B 35/638)}	3/1233	. . . . {Organic material}
3/1025	. . . . {not by heating only}	3/1241	. . . . {layered}
3/1028	. . . {Controlled cooling}	3/125	. . . {Initially porous container}
2003/1032	. . {comprising a grain growth inhibitor}	3/1258	. . . {Container manufacturing}
3/1035	. . {Liquid phase sintering}	3/1266	. . . . {by coating or sealing the surface of the preformed article, e.g. by melting}
3/1039	. . {by reaction (B22F 3/001 , B22F 3/23 take precedence)}	3/1275	. . . . {by coating a model and eliminating the model before consolidation}
2003/1042	. . {with support for articles to be sintered}	3/1283	. . . . {Container formed as an undeformable model eliminated after consolidation}
2003/1046	. . . {with separating means for articles to be sintered}	3/1291	. . . . {Solid insert eliminated after consolidation}
3/105	. . by using electric current {other than for infra-red radiant energy}, laser radiation or plasma (B22F 3/11 takes precedence) ; by ultrasonic bonding (B22F 3/115 takes precedence)}	3/14	. . simultaneously
2003/1051	. . . {by electric discharge}	2003/145	. . . {by warm compacting, below debinding temperature}
2003/1052	. . . {assisted by energy absorption enhanced by the coating or powder}	3/15	. . . Hot isostatic pressing
2003/1053	. . . {by induction}	2003/153	. . . . {apparatus specific to HIP}
2003/1054	. . . {by microwave}	3/156	. . . . {by a pressure medium in liquid or powder form}

- 3/16 . . in successive or repeated steps
- 3/162 . . . {Machining, working after consolidation}
- 3/164 . . . {Partial deformation or calibration}
- 2003/166 {Surface calibration, blasting, burnishing, sizing, coining}
- 3/168 {Local deformation}
- 3/17 . . by forging
- 3/172 . . {Continuous compaction, e.g. rotary hammering (with axial pressure and without reduction of section [B22F 3/204](#))}
- 2003/175 . . {by hot forging, below sintering temperature}
- 3/177 . . {Rocking die forging}
- 3/18 . . by using pressure rollers
- 2003/185 . . {by hot rolling, below sintering temperature}
- 3/20 . . by extruding
- 2003/202 . . {with back pressure}
- 3/204 . . {Continuous compaction with axial pressure and without reduction of section}
- 2003/206 . . {Hydrostatic or hydraulic extrusion}
- 2003/208 . . {Warm or hot extruding}
- 3/22 . . for producing castings from a slip
- 3/222 . . {by freeze-casting or in a supercritical fluid}
- 3/225 . . {by injection molding}
- 3/227 . . {by organic binder assisted extrusion}
- 3/23 . . involving a self-propagating high-temperature synthesis or reaction sintering step {(making cermets by reaction sintering [C22C 1/058](#))}
- 3/24 . . After-treatment of workpieces or articles {([B22F 3/1146](#) takes precedence)}
- 2003/241 . . {Chemical after-treatment on the surface}
- 2003/242 . . . {Coating}
- 2003/244 . . . {Leaching}
- 2003/245 . . {Making recesses, grooves etc on the surface by removing material}
- 2003/247 . . {Removing material: carving, cleaning, grinding, hobbing, honing, lapping, polishing, milling, shaving, skiving, turning the surface}
- 2003/248 . . {Thermal after-treatment}
- 3/26 . . Impregnating {(making ferrous alloys by impregnation [C22C 33/0242](#))}
- 5/00 Manufacture of workpieces or articles from metallic powder characterised by the special shape of the product**
- 2005/001 . . {Cutting tools, earth boring or grinding tool other than table ware}
- 2005/002 . . {Tools other than cutting tools}
- 5/003 . . {Articles made for being fractured or separated into parts}
- 2005/004 . . {Article comprising helical form elements ([B22F 5/085](#) takes precedence)}
- 2005/005 . . {Article surface comprising protrusions}
- 5/006 . . {of flat products, e.g. sheets ([B22F 3/1103](#) takes precedence; by using pressure rollers only see [B22F 3/18](#))}
- 5/007 . . {of moulds}
- 5/008 . . {of engine cylinder parts or of piston parts other than piston rings (of piston rings [B22F 5/02](#))}
- 5/009 . . {of turbine components other than turbine blades (of turbine blades [B22F 5/04](#))}
- 5/02 . . of piston rings
- 5/04 . . of turbine blades
- 5/06 . . of threaded articles, e.g. nuts
- 5/08 . . of toothed articles, e.g. gear wheels; of cam discs
- 5/085 . . {with helical contours}
- 5/10 . . of articles with cavities or holes, not otherwise provided for in the preceding subgroups
- 2005/103 . . {Cavity made by removal of insert}
- 5/106 . . {Tube or ring forms}
- 5/12 . . of wires {(of tubes [B22F 5/10](#))}
- 7/00 Manufacture of composite layers, workpieces, or articles, comprising metallic powder, by sintering the powder, with or without compacting {wherein at least one part is obtained by sintering or compression (application of coating layers by use of metal powders, see [C23C](#))}**
- . . {of porous nature}
- . . . {comprising at least one non-porous part}
- {the porous part being obtained by foaming}
- . . {characterised by the composition}
- . . of composite layers {([B22F 7/002](#) takes precedence)}
- 7/04 . . with one or more layers not made from powder, e.g. made from solid metal
- 2007/042 . . . {characterised by the layer forming method}
- 2007/045 {accompanied by fusion or impregnation}
- 2007/047 {non-pressurised baking of the paste or slurry containing metal powder}
- 7/06 . . of composite workpieces or articles from parts, e.g. to form tipped tools {([B22F 7/002](#) takes precedence)}
- 7/062 . . {involving the connection or repairing of preformed parts}
- 7/064 . . . {using an intermediate powder layer}
- 2007/066 . . . {using impregnation}
- 2007/068 . . . {repairing articles}
- 7/08 . . with one or more parts not made from powder {([B22F 7/062](#) takes precedence)}
- 8/00 Manufacture of articles from scrap or waste metal particles**
- 9/00 Making metallic powder or suspensions thereof**
- 2009/001 . . {from scrap particles}
- 9/002 . . {amorphous or microcrystalline}
- 9/004 . . {by diffusion, e.g. solid state reaction}
- 9/005 . . . {Transformation into amorphous state by milling}
- 9/007 . . {Transformation of amorphous into microcrystalline state}
- 9/008 . . {Rapid solidification processing}
- 9/02 . . using physical processes
- 9/023 . . {Hydrogen absorption}
- 9/026 . . {Spray drying of solutions or suspensions}
- 9/04 . . starting from solid material, e.g. by crushing, grinding or milling {([C22C 1/1084](#) takes precedence); crushing, grinding or milling, in general, see the relevant subclasses, e.g. [B02C](#)}
- 2009/041 . . . {by mechanical alloying, e.g. blending, milling}
- 2009/042 . . . {using a particular milling fluid}
- 2009/043 . . . {by ball milling}
- 2009/044 . . . {by jet milling}
- 2009/045 . . . {by other means than ball or jet milling}
- 2009/046 {by cutting}
- 2009/047 {by rolling}

2009/048	. . . {by pulverising a quenched ribbon}	9/305	. . . {of metal carbonyls}
2009/049	. . . {by pulverising at particular temperature}	2201/00	Treatment under specific atmosphere
9/06	. . starting from liquid material	2201/01	. Reducing atmosphere
2009/065	. . . {Melting inside a liquid, e.g. making spherical balls}	2201/013	. . Hydrogen
9/08	. . . by casting, e.g. through sieves or in water, by atomising or spraying (using electric discharge B22F 9/14)	2201/016	. . NH ₃
2009/0804	. . . . {Dispersion in or on liquid, other than with sieves}	2201/02	. Nitrogen
2009/0808	. . . . . {Mechanical dispersion of melt, e.g. by sieves}	2201/03	. Oxygen
2009/0812	. . . . . {Pulverisation with a moving liquid coolant stream, by centrifugally rotating stream}	2201/04	. CO or CO ₂
2009/0816	. . . . . {by casting with pressure or pulsating pressure on the metal bath}	2201/05	. Water or water vapour
9/082	. . . . . {atomising using a fluid (using centrifugal force B22F 9/10)}	2201/10	. Inert gases
2009/0824	. . . . . {with a specific atomising fluid}	2201/11	. . Argon
2009/0828	. . . . . {with water}	2201/12	. . Helium
2009/0832	. . . . . {Handling of atomising fluid, e.g. heating, cooling, cleaning, recirculating}	2201/20	. Use of vacuum
2009/0836	. . . . . {with electric or magnetic field or induction}	2201/30	. Carburising atmosphere
2009/084	. . . . . {combination of methods}	2201/32	. Decarburising atmosphere
2009/0844	. . . . . {in controlled atmosphere}	2201/40	. Metal compounds
2009/0848	. . . . . {Melting process before atomisation}	2201/50	. air
2009/0852	. . . . . {Electroslag melting}	2202/00	Treatment under specific physical conditions
2009/0856	. . . . . {Skull melting}	2202/01	. Use of vibrations
2009/086	. . . . . {Cooling after atomisation}	2202/03	. Treatment under cryogenic or supercritical conditions
2009/0864	. . . . . {by oil, other non-aqueous fluid or fluid-bed cooling}	2202/05	. Use of magnetic field
2009/0868	. . . . . {by injection of solid particles in the melt stream}	2202/06	. Use of electric fields
2009/0872	. . . . . {by water}	2202/07	. by induction
2009/0876	. . . . . {by gas}	2202/09	. Use of non-gravitational conditions
2009/088	. . . . . {Fluid nozzles, e.g. angle, distance}	2202/11	. Use of irradiation
2009/0884	. . . . . {Spiral fluid}	2202/13	. Use of plasma
2009/0888	. . . . . {casting construction of the melt process, apparatus, intermediate reservoir, e.g. tundish, devices for temperature control}	2202/15	. Use of fluidised beds
2009/0892	. . . . . {casting nozzle; controlling metal stream in or after the casting nozzle}	2202/17	. use of centrifugal or vortex forces
2009/0896	. . . . . {particle transport, separation: process and apparatus}	2203/00	Controlling
9/10	. . . . . using centrifugal force	2203/01	. To-be-deleted with administrative transfer to B22F 2203/00
9/12	. . starting from gaseous material	2203/03	. for feed-back
9/14	. . using electric discharge	2203/05	. thermal expansion
9/16	. using chemical processes	2203/11	. temperature, temperature profile
2009/165	. . {Chemical reaction in an Ionic Liquid [IL] (B22F 2009/245 takes precedence)}	2203/13	. pressure
9/18	. . with reduction of metal compounds	2203/15	. weight
9/20	. . . starting from solid metal compounds	2207/00	Aspects of the compositions, gradients
9/22	. . . . using gaseous reductors	2207/01	. Composition gradients
9/24	. . . starting from liquid metal compounds, e.g. solutions	2207/03	. . of the metallic binder phase in cermets
2009/245	. . . . {Reduction reaction in an Ionic Liquid [IL]}	2207/05	. . . eta-phase
9/26	. . . . using gaseous reductors	2207/07	. . Particles with core-rim gradient
9/28	. . . starting from gaseous metal compounds	2207/11	. Gradients other than composition gradients, e.g. size gradients
9/30	. . with decomposition of metal compounds, e.g. by pyrolysis	2207/13	. . Size gradients
		2207/15	. . Temperature gradients
		2207/17	. . density or porosity gradients
		2207/20	. Cooperating components
		2301/00	Metallic composition of the powder or its coating
		2301/05	. Light metals
		2301/052	. . Aluminium
		2301/054	. . Alkali metals, i.e. Li, Na, K, Rb, Cs, Fr
		2301/056	. . Alkaline metals, i.e. Ca, Sr, Ba, Ra
		2301/058	. . Magnesium
		2301/10	. Copper
		2301/15	. Nickel or cobalt
		2301/155	. . Rare Earth - Co or -Ni intermetallic alloys
		2301/20	. Refractory metals
		2301/205	. . Titanium, zirconium or hafnium

2301/25	. Noble metals, i.e. Ag Au, Ir, Os, Pd, Pt, Rh, Ru
2301/255	. . Silver or gold
2301/30	. Low melting point metals, i.e. Zn, Pb, Sn, Cd, In, Ga
2301/35	. Iron
2301/355	. . Rare Earth - Fe intermetallic alloys
2301/40	. Intermetallics other than rare earth-Co or -Ni or -Fe intermetallic alloys
2301/45	. Rare earth metals, i.e. Sc, Y, Lanthanides (57-71)
2302/00	Metal Compound, non-Metallic compound or non-metal composition of the powder or its coating
2302/05	. Boride
2302/10	. Carbide
2302/105	. . Silicium carbide (SiC)
2302/15	. Carbonitride
2302/20	. Nitride
2302/205	. Cubic boron nitride
2302/25	. Oxide
2302/253	. . Aluminum oxide (Al ₂ O ₃)
2302/256	. . Silicium oxide (SiO ₂)
2302/30	. Oxynitride
2302/35	. Complex boride, carbide, carbonitride, nitride, oxide or oxynitride
2302/40	. Carbon, graphite
2302/403	. . Carbon nanotube
2302/406	. . Diamond
2302/45	. Others, including non-metals
2303/00	Functional details of metal or compound in the powder or product,
2303/01	. Main component
2303/05	. Compulsory alloy component
2303/10	. Optional alloy component
2303/15	. Intermetallic
2303/20	. Coating by means of particles
2303/25	. Coating by means of fibres
2303/30	. Coating alloy
2303/35	. Molten metal infiltrating a metal preform
2303/40	. Layer in a composite stack of layers, workpiece or article
2303/405	. . Support layer
2303/45	. Part of a final mixture to be processed further
2304/00	Physical aspects of the powder
2304/05	. Submicron size particles
2304/052	. . Particle size below 1nm
2304/054	. . Particle size between 1 and 100 nm
2304/056	. . Particle size above 100 nm up to 300 nm
2304/058	. . Particle size above 300 nm up to 1 micrometer
2304/10	. Micron size particles, i.e. above 1 micrometer up to 500 micrometer
2304/15	. Millimeter size particles, i.e. above 500 micrometer
2998/00	Supplementary information concerning processes or compositions relating to powder metallurgy
2998/10	. Processes characterised by the sequence of their steps
2999/00	Aspects linked to processes or compositions used in powder metallurgy