

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.

WARNING

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](#)

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)}	1/0059	. . {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 per se; 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)}
1/0055	. . . {Flake form powders}		

3/002	. {Manufacture of articles essentially made from metallic fibres}	2003/1057	. . . . . {for control or data processing, e.g. algorithms}
3/003	. {Apparatus, e.g. furnaces (in general F27B)}	2003/1058	. . . . . {Support structures for the 3D object during manufacturing, e.g. using sacrificial material}
3/004	. {Filling molds with powder (feeding material to presses in general B30B 15/302)}	2003/1059	. . . . . {for cleaning or recycling}
3/005	. {Loading or unloading powder metal objects (transport in general B65G)}	3/11	. . Making porous workpieces or articles
3/006	. {Amorphous articles}	3/1103	. . . {with particular physical characteristics}
3/007	. . {by diffusion starting from non-amorphous articles prepared by powder metallurgy}	2003/1106	. . . . {Product comprising closed porosity}
3/008	. {Selective deposition modelling (B22F 3/1055 takes precedence)}	3/1109	. . . . {Inhomogenous pore distribution (composite layers of porous nature B22F 7/002)}
3/02	. Compacting only	3/1112	. . . . {comprising hollow spheres or hollow fibres}
2003/023	. . {Lubricant mixed with the metal powder}	3/1115	. . . . {comprising complex forms, e.g. honeycombs}
2003/026	. . {Mold wall lubrication or article surface lubrication}	3/1118	. . . . {comprising internal reinforcements}
3/03	. . Press-moulding apparatus therefor	3/1121	. . . {by using decomposable, meltable or sublimateable fillers}
2003/031	. . . {with punches moving in different directions in different planes}	3/1125	. . . . {involving a foaming process}
2003/033	. . . {with multiple punches working in the same direction}	2003/1128	. . . . . {Foaming by expansion of dissolved gas, other than with foaming agent}
3/04	. . by applying fluid pressure {, e.g. by cold isostatic pressing [CIP]}	2003/1131	. . . . . {Foaming in a liquid suspension and decomposition}
3/045	. . . {Semi-isostatic pressure}	3/1134	. . . . {Inorganic fillers (carbonaceous or paper filler B22F 3/1121)}
3/06	. . by centrifugal forces	3/1137	. . . . {by coating porous removable preforms}
3/08	. . by explosive forces {(generating shock waves in general G10K 15/043)}	3/114	. . . {the porous products being formed by impregnation (B22F 3/1137 , B22F 3/26 take precedence)}
3/087	. . using high energy impulses, e.g. magnetic field impulses	3/1143	. . . {involving an oxidation, reduction or reaction step}
3/093	. . using vibrations {or friction}	3/1146	. . . {After-treatment maintaining the porosity (B22F 3/114 takes precedence)}
3/10	. Sintering only	3/115	. by spraying molten metal, i.e. spray sintering, spray casting
3/1003	. . {Use of special medium during sintering, e.g. sintering aid}	3/12	. Both compacting and sintering (by forging B22F 3/17)
3/1007	. . . {Atmosphere (B22F 3/1021 takes precedence)}	3/1208	. . {Containers or coating used therefor}
3/101	. . . . {Changing atmosphere}	3/1216	. . . {Container composition}
2003/1014	. . . {Getter}	3/1225	. . . . {Glass}
3/1017	. . {Multiple heating or additional steps (B22F 3/101 takes precedence)}	3/1233	. . . . {Organic material}
3/1021	. . . {Removal of binder or filler (removal of binder from ceramics C04B 35/638)}	3/1241	. . . . {layered}
3/1025	. . . . {not by heating only}	3/125	. . . {Initially porous container}
3/1028	. . . {Controlled cooling}	3/1258	. . . {Container manufacturing}
2003/1032	. . {comprising a grain growth inhibitor}	3/1266	. . . . {by coating or sealing the surface of the preformed article, e.g. by melting}
3/1035	. . {Liquid phase sintering}	3/1275	. . . . {by coating a model and eliminating the model before consolidation}
3/1039	. . {by reaction (B22F 3/001 , B22F 3/23 take precedence)}	3/1283	. . . . {Container formed as an undeformable model eliminated after consolidation}
2003/1042	. . {with support for articles to be sintered}	3/1291	. . . . {Solid insert eliminated after consolidation}
2003/1046	. . . {with separating means for articles to be sintered}	3/14	. . simultaneously
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)}	2003/145	. . . {by warm compacting, below debinding temperature}
2003/1051	. . . {by electric discharge}	3/15	. . . Hot isostatic pressing
2003/1052	. . . {assisted by energy absorption enhanced by the coating or powder}	2003/153	. . . . {apparatus specific to HIP}
2003/1053	. . . {by induction}	3/156	. . . . {by a pressure medium in liquid or powder form}
2003/1054	. . . {by microwave}	3/16	. . in successive or repeated steps
3/1055	. . . {Selective sintering, i.e. stereolithography (selective sintering of powdered plastics B29C 64/153)}	3/162	. . . {Machining, working after consolidation}
2003/1056	. . . . {Apparatus components, details or accessories}	3/164	. . . {Partial deformation or calibration}
		2003/166	. . . . {Surface calibration, blasting, burnishing, sizing, coining}

3/168	. . . . {Local deformation}	5/106	. . {Tube or ring forms}
3/17	. by forging	5/12	. of wires {(of tubes B22F 5/10)}
3/172	. . {Continuous compaction, e.g. rotary hammering (with axial pressure and without reduction of section B22F 3/204)}	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)}
2003/175	. . {by hot forging, below sintering temperature}	7/002	. {of porous nature}
3/177	. . {Rocking die forging}	7/004	. . {comprising at least one non-porous part}
3/18	. by using pressure rollers	7/006	. . . {the porous part being obtained by foaming}
2003/185	. . {by hot rolling, below sintering temperature}	7/008	. {characterised by the composition}
3/20	. by extruding	7/02	. of composite layers {(B22F 7/002 takes precedence)}
2003/202	. . {with back pressure}	7/04	. . with one or more layers not made from powder, e.g. made from solid metal
3/204	. . {Continuous compaction with axial pressure and without reduction of section}	2007/042	. . . {characterised by the layer forming method}
2003/206	. . {Hydrostatic or hydraulic extrusion}	2007/045	. . . . {accompanied by fusion or impregnation}
2003/208	. . {Warm or hot extruding}	2007/047	. . . . {non-pressurised baking of the paste or slurry containing metal powder}
3/22	. for producing castings from a slip	7/06	. of composite workpieces or articles from parts, e.g. to form tipped tools {(B22F 7/002 takes precedence)}
3/222	. . {by freeze-casting or in a supercritical fluid}	7/062	. . {involving the connection or repairing of preformed parts}
3/225	. . {by injection molding}	7/064	. . . {using an intermediate powder layer}
3/227	. . {by organic binder assisted extrusion}	2007/066	. . . {using impregnation}
3/23	. involving a self-propagating high-temperature synthesis or reaction sintering step {(making cermets by reaction sintering C22C 1/058)}	2007/068	. . . {repairing articles}
3/24	. After-treatment of workpieces or articles {(B22F 3/1146 takes precedence)}	7/08	. . with one or more parts not made from powder {(B22F 7/062 takes precedence)}
2003/241	. . {Chemical after-treatment on the surface}	8/00	Manufacture of articles from scrap or waste metal particles
2003/242	. . . {Coating}	9/00	Making metallic powder or suspensions thereof
2003/244	. . . {Leaching}	2009/001	. {from scrap particles}
2003/245	. . {Making recesses, grooves etc on the surface by removing material}	9/002	. {amorphous or microcrystalline}
2003/247	. . {Removing material: carving, cleaning, grinding, hobbing, honing, lapping, polishing, milling, shaving, skiving, turning the surface}	9/004	. . {by diffusion, e.g. solid state reaction}
2003/248	. . {Thermal after-treatment}	9/005	. . . {Transformation into amorphous state by milling}
3/26	. . Impregnating {(making ferrous alloys by impregnation C22C 33/0242)}	9/007	. . {Transformation of amorphous into microcrystalline state}
5/00	Manufacture of workpieces or articles from metallic powder characterised by the special shape of the product	9/008	. . {Rapid solidification processing}
2005/001	. {Cutting tools, earth boring or grinding tool other than table ware}	9/02	. using physical processes
2005/002	. {Tools other than cutting tools}	9/023	. . {Hydrogen absorption}
5/003	. {Articles made for being fractured or separated into parts}	9/026	. . {Spray drying of solutions or suspensions}
2005/004	. {Article comprising helical form elements (B22F 5/085 takes precedence)}	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 }
2005/005	. {Article surface comprising protrusions}	2009/041	. . . {by mechanical alloying, e.g. blending, milling}
5/006	. {of flat products, e.g. sheets (B22F 3/1103 takes precedence; by using pressure rollers only see B22F 3/18)}	2009/042	. . . {using a particular milling fluid}
5/007	. {of moulds}	2009/043	. . . {by ball milling}
5/008	. {of engine cylinder parts or of piston parts other than piston rings (of piston rings B22F 5/02)}	2009/044	. . . {by jet milling}
5/009	. {of turbine components other than turbine blades (of turbine blades B22F 5/04)}	2009/045	. . . {by other means than ball or jet milling}
5/02	. of piston rings	2009/046	. . . . {by cutting}
5/04	. of turbine blades	2009/047	. . . . {by rolling}
5/06	. of threaded articles, e.g. nuts	2009/048	. . . {by pulverising a quenched ribbon}
5/08	. of toothed articles, e.g. gear wheels; of cam discs	2009/049	. . . {by pulverising at particular temperature}
5/085	. . {with helical contours}	9/06	. . starting from liquid material
5/10	. of articles with cavities or holes, not otherwise provided for in the preceding subgroups	2009/065	. . . {Melting inside a liquid, e.g. making spherical balls}
2005/103	. . {Cavity made by removal of insert}		

9/08	. . . by casting, e.g. through sieves or in water, by atomising or spraying (using electric discharge B22F 9/14)	2201/02	. Nitrogen
2009/0804	. . . . {Dispersion in or on liquid, other than with sieves}	2201/03	. Oxygen
2009/0808	. . . . . {Mechanical dispersion of melt, e.g. by sieves}	2201/04	. CO or CO ₂
2009/0812	. . . . . {Pulverisation with a moving liquid coolant stream, by centrifugally rotating stream}	2201/05	. Water or water vapour
2009/0816	. . . . . {by casting with pressure or pulsating pressure on the metal bath}	2201/10	. Inert gases
9/082	. . . . . {atomising using a fluid (using centrifugal force B22F 9/10)}	2201/11	. . Argon
2009/0824	. . . . . {with a specific atomising fluid}	2201/12	. . Helium
2009/0828	. . . . . {with water}	2201/20	. Use of vacuum
2009/0832	. . . . . {Handling of atomising fluid, e.g. heating, cooling, cleaning, recirculating}	2201/30	. Carburising atmosphere
2009/0836	. . . . . {with electric or magnetic field or induction}	2201/32	. Decarburising atmosphere
2009/084	. . . . . {combination of methods}	2201/40	. Metal compounds
2009/0844	. . . . . {in controlled atmosphere}	2201/50	. air
2009/0848	. . . . . {Melting process before atomisation}	2202/00	Treatment under specific physical conditions
2009/0852	. . . . . {Electroslag melting}	2202/01	. Use of vibrations
2009/0856	. . . . . {Skull melting}	2202/03	. Treatment under cryogenic or supercritical conditions
2009/086	. . . . . {Cooling after atomisation}	2202/05	. Use of magnetic field
2009/0864	. . . . . {by oil, other non-aqueous fluid or fluid-bed cooling}	2202/06	. Use of electric fields
2009/0868	. . . . . {by injection of solid particles in the melt stream}	2202/07	. by induction
2009/0872	. . . . . {by water}	2202/09	. Use of non-gravitational conditions
2009/0876	. . . . . {by gas}	2202/11	. Use of irradiation
2009/088	. . . . . {Fluid nozzles, e.g. angle, distance}	2202/13	. Use of plasma
2009/0884	. . . . . {Spiral fluid}	2202/15	. Use of fluidised beds
2009/0888	. . . . . {casting construction of the melt process, apparatus, intermediate reservoir, e.g. tundish, devices for temperature control}	2202/17	. use of centrifugal or vortex forces
2009/0892	. . . . . {casting nozzle; controlling metal stream in or after the casting nozzle}	2203/00	Controlling
2009/0896	. . . . . {particle transport, separation: process and apparatus}	2203/01	. To-be-deleted with administrative transfer to B22F 2203/00
9/10	. . . . using centrifugal force	2203/03	. for feed-back
9/12	. . starting from gaseous material	2203/05	. thermal expansion
9/14	. . using electric discharge	2203/11	. temperature, temperature profile
9/16	. . using chemical processes	2203/13	. pressure
2009/165	. . {Chemical reaction in an Ionic Liquid [IL] (B22F 2009/245 takes precedence)}	2203/15	. weight
9/18	. . with reduction of metal compounds	2207/00	Aspects of the compositions, gradients
9/20	. . . starting from solid metal compounds	2207/01	. Composition gradients
9/22	. . . using gaseous reductors	2207/03	. . of the metallic binder phase in cermets
9/24	. . . starting from liquid metal compounds, e.g. solutions	2207/05	. . . eta-phase
2009/245	. . . . {Reduction reaction in an Ionic Liquid [IL]}	2207/07	. . Particles with core-rim gradient
9/26	. . . using gaseous reductors	2207/11	. Gradients other than composition gradients, e.g. size gradients
9/28	. . . starting from gaseous metal compounds	2207/13	. . Size gradients
9/30	. . with decomposition of metal compounds, e.g. by pyrolysis	2207/15	. . Temperature gradients
9/305	. . . {of metal carbonyls}	2207/17	. . density or porosity gradients
2201/00	Treatment under specific atmosphere	2207/20	. Cooperating components
2201/01	. Reducing atmosphere	2301/00	Metallic composition of the powder or its coating
2201/013	. . Hydrogen	2301/05	. Light metals
2201/016	. . NH ₃	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 (Al₂O₃)
- 2302/256 . . Silicium oxide (SiO₂)
- 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**