

CPC COOPERATIVE PATENT CLASSIFICATION

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 used in the CPC scheme. Subject matter covered by these 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)}	1/0074	. . . {Organic materials comprising a solvent, e.g. for slip casting}
		1/0077	. . . {Mixtures obtained by warm mixing}
		1/0081	. {Special treatment of metallic powder, e.g. to facilitate working, to improve properties (coating with organic material B22F 1/0062)}
		1/0085	. . {Thermal or thermo-mechanical treatment}
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)}	1/0088	. . {Chemical treatment, e.g. passivation}
		2001/0092	. . . {Making a dispersion}
		1/0096	. . {Treatment resulting in the production of agglomerates}
1/0007	. . {Metallic powder characterised by its shape or structure, e.g. fibre structure}	1/02	. comprising coating of the powder {(coating with organic material B22F 1/0062 ; chemical surface treatment B22F 1/0088)}
1/0011	. . . {Metallic powder characterised by size or surface area only}	1/025	. . {Metallic coating}
1/0014	. . . . {by size mixtures or distribution}	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}
1/0018	. . . . {Nanometer sized particles}		
1/0022	. . . . . {Dispersions or suspensions thereof}	3/001	. {Starting from powder comprising reducible metal compounds (making ferrous alloys starting from compounds C22C 33/0235)}
1/0025	. . . . . {Nanofibres or nanotubes}	3/002	. {Manufacture of articles essentially made from metallic fibres}
2001/0029	. . . . . {Hollow particles, including tubes and shells}	3/003	. {Apparatus, e.g. furnaces (in general F27B)}
2001/0033	. . . . . {Flake form nanoparticles}	3/004	. {Filling molds with powder (feeding material to presses in general B30B 15/302)}
2001/0037	. . . . . {Complex form nanoparticles, e.g.. prism, pyramid, octahedron}	3/005	. {Loading or unloading powder metal objects (transport in general B65G)}
1/004	. . . {Fibre structure (B22F 1/0025 takes precedence)}	3/006	. {Amorphous articles}
1/0044	. . . {Nanometer size structures}	3/007	. . {by diffusion starting from non-amorphous articles prepared by powder metallurgy}
1/0048	. . . {Spherical powder}	3/008	. {Selective deposition modelling (B22F 3/1055 takes precedence)}
1/0051	. . . . {Hollow particles}	3/02	. Compacting only
1/0055	. . . {Flake form powders}	2003/023	. . {Lubricant mixed with the metal powder}
1/0059	. . {Metallic powders mixed with a lubricating or binding agent or organic material}	2003/026	. . {Mold wall lubrication or article surface lubrication}
1/0062	. . . {Powders coated with organic material}	3/03	. . Press-moulding apparatus therefor
2001/0066	. . . {Organic binder comprising a mixture or obtained by reaction of more than one component other than solvent, lubricant}		
1/007	. . . {Non-organic or metal salt binders or lubricants}		

- 2003/031 . . . {with punches moving in different directions in different planes}
- 2003/033 . . . {with multiple punches working in the same direction}
 - 3/04 . . by applying fluid pressure {, e.g. by cold isostatic pressing [CIP]}
 - 3/045 . . . {Semi-isostatic pressure}
 - 3/06 . . by centrifugal forces
 - 3/08 . . by explosive forces {(generating shock waves in general [G10K 15/043](#))}
 - 3/087 . . using high energy impulses, e.g. magnetic field impulses
 - 3/093 . . using vibrations {or friction}
 - 3/10 . . Sintering only
 - 3/1003 . . {Use of special medium during sintering, e.g. sintering aid}
 - 3/1007 . . . {Atmosphere ([B22F 3/1021](#) takes precedence)}
 - 3/101 {Changing atmosphere}
- 2003/1014 . . . {Getter}
- 3/1017 . . {Multiple heating or additional steps ([B22F 3/101](#) takes precedence)}
- 3/1021 . . . {Removal of binder or filler (removal of binder from ceramics [C04B 35/638](#))}
- 3/1025 {not by heating only}
- 3/1028 . . . {Controlled cooling}
- 2003/1032 . . {comprising a grain growth inhibitor}
- 3/1035 . . {Liquid phase sintering}
- 3/1039 . . {by reaction ([B22F 3/001](#), [B22F 3/23](#) take precedence)}
- 2003/1042 . . {with support for articles to be sintered}
- 2003/1046 . . . {with separating means for articles to be sintered}
 - 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)}
- 2003/1051 . . . {by electric discharge}
- 2003/1052 . . . {assisted by energy absorption enhanced by the coating or powder}
- 2003/1053 . . . {by induction}
- 2003/1054 . . . {by microwave}
- 3/1055 . . . {Selective sintering, i.e. stereolithography (selective sintering of powdered plastics [B29C 67/0077](#))}
- 2003/1056 {Apparatus components, details or accessories}
- 2003/1057 {for control or data processing, e.g. algorithms}
- 2003/1058 {Support structures for the 3D object during manufacturing, e.g. using sacrificial material}
- 2003/1059 {for cleaning or recycling}
 - 3/11 . . Making porous workpieces or articles
 - 3/1103 . . . {with particular physical characteristics}
- 2003/1106 {Product comprising closed porosity}
- 3/1109 {Inhomogenous pore distribution (composite layers of porous nature [B22F 7/002](#))}
- 3/1112 {comprising hollow spheres or hollow fibres}
- 3/1115 {comprising complex forms, e.g. honeycombs}
- 3/1118 {comprising internal reinforcements}
- 3/1121 {by using decomposable, meltable or sublimateable fillers}
- 3/1125 {involving a foaming process}
- 2003/1128 {Foaming by expansion of dissolved gas, other than with foaming agent}
- 2003/1131 {Foaming in a liquid suspension and decomposition}
- 3/1134 {Inorganic fillers (carbonaceous or paper filler [B22F 3/1121](#))}
- 3/1137 {by coating porous removable preforms}
- 3/114 . . . {the porous products being formed by impregnation ([B22F 3/1137](#), [B22F 3/26](#) take precedence)}
- 3/1143 . . . {involving an oxidation, reduction or reaction step}
- 3/1146 . . . {After-treatment maintaining the porosity ([B22F 3/114](#) takes precedence)}
- 3/115 . . by spraying molten metal, i.e. spray sintering, spray casting
- 3/12 . . Both compacting and sintering (by forging [B22F 3/17](#))
- 3/1208 . . {Containers or coating used therefor}
- 3/1216 . . . {Container composition}
- 3/1225 {Glass}
- 3/1233 {Organic material}
- 3/1241 {layered}
- 3/125 . . . {Initially porous container}
- 3/1258 . . . {Container manufacturing}
- 3/1266 {by coating or sealing the surface of the preformed article, e.g. by melting}
- 3/1275 {by coating a model and eliminating the model before consolidation}
- 3/1283 {Container formed as an undeformable model eliminated after consolidation}
- 3/1291 {Solid insert eliminated after consolidation}
- 3/14 . . simultaneously
- 2003/145 . . . {by warm compacting, below debinding temperature}
- 3/15 . . . Hot isostatic pressing
- 2003/153 {apparatus specific to HIP}
- 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}	2007/042	. . . {characterised by the layer forming method}
3/225	. . {by injection molding}	2007/045	. . . . {accompanied by fusion or impregnation}
3/227	. . {by organic binder assisted extrusion}	2007/047	. . . . {non-pressurised baking of the paste or slurry containing metal powder}
3/23	. involving a self-propagating high-temperature synthesis or reaction sintering step {(making cermets by reaction sintering C22C 1/058)}	7/06	. of composite workpieces or articles from parts, e.g. to form tipped tools {(B22F 7/002 takes precedence)}
3/24	. After-treatment of workpieces or articles {(B22F 3/1146 takes precedence)}	7/062	. . {involving the connection or repairing of preformed parts}
2003/241	. . {Chemical after-treatment on the surface}	7/064	. . . {using an intermediate powder layer}
2003/242	. . . {Coating}	2007/066	. . . {using impregnation}
2003/244	. . . {Leaching}	2007/068	. . . {repairing articles}
2003/245	. . {Making recesses, grooves etc on the surface by removing material}	7/08	. . with one or more parts not made from powder {(B22F 7/062 takes precedence)}
2003/247	. . {Removing material: carving, cleaning, grinding, hobbing, honing, lapping, polishing, milling, shaving, skiving, turning the surface}	8/00	Manufacture of articles from scrap or waste metal particles
2003/248	. . {Thermal after-treatment}	9/00	Making metallic powder or suspensions thereof
3/26	. . Impregnating {(making ferrous alloys by impregnation C22C 33/0242)}	2009/001	. {from scrap particles}
5/00	Manufacture of workpieces or articles from metallic powder characterised by the special shape of the product	9/002	. {amorphous or microcrystalline}
2005/001	. {Cutting tools, earth boring or grinding tool other than table ware}	9/004	. . {by diffusion, e.g. solid state reaction}
2005/002	. {Tools other than cutting tools}	9/005	. . . {Transformation into amorphous state by milling}
5/003	. {Articles made for being fractured or separated into parts}	9/007	. . {Transformation of amorphous into microcrystalline state}
2005/004	. {Article comprising helical form elements (B22F 5/085 takes precedence)}	9/008	. . {Rapid solidification processing}
2005/005	. {Article surface comprising protrusions}	9/02	. using physical processes
5/006	. {of flat products, e.g. sheets (B22F 3/1103 takes precedence; by using pressure rollers only see B22F 3/18)}	9/023	. . {Hydrogen absorption}
5/007	. {of moulds}	9/026	. . {Spray drying of solutions or suspensions}
5/008	. {of engine cylinder parts or of piston parts other than piston rings (of piston rings B22F 5/02)}	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 }
5/009	. {of turbine components other than turbine blades (of turbine blades B22F 5/04)}	2009/041	. . . {by mechanical alloying, e.g. blending, milling}
5/02	. of piston rings	2009/042	. . . . {using a particular milling fluid}
5/04	. of turbine blades	2009/043	. . . . {by ball milling}
5/06	. of threaded articles, e.g. nuts	2009/044	. . . . {by jet milling}
5/08	. of toothed articles, e.g. gear wheels; of cam discs	2009/045	. . . . {by other means than ball or jet milling}
5/085	. . {with helical contours}	2009/046	. . . . . {by cutting}
5/10	. of articles with cavities or holes, not otherwise provided for in the preceding subgroups	2009/047	. . . . . {by rolling}
2005/103	. . {Cavity made by removal of insert}	2009/048	. . . . {by pulverising a quenched ribbon}
5/106	. . {Tube or ring forms}	2009/049	. . . . {by pulverising at particular temperature}
5/12	. of wires {(of tubes B22F 5/10)}	9/06	. . starting from liquid material
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)}	2009/065	. . . . {Melting inside a liquid, e.g. making spherical balls}
7/002	. {of porous nature}	9/08	. . . . by casting, e.g. through sieves or in water, by atomising or spraying (using electric discharge B22F 9/14)
7/004	. . {comprising at least one non-porous part}	2009/0804	. . . . . {Dispersion in or on liquid, other than with sieves}
7/006	. . . {the porous part being obtained by foaming}	2009/0808	. . . . . {Mechanical dispersion of melt, e.g. by sieves}
7/008	. {characterised by the composition}	2009/0812	. . . . . {Pulverisation with a moving liquid coolant stream, by centrifugally rotating stream}
7/02	. of composite layers {(B22F 7/002 takes precedence)}	2009/0816	. . . . . {by casting with pressure or pulsating pressure on the metal bath}
7/04	. . with one or more layers not made from powder, e.g. made from solid metal	9/082	. . . . . {atomising using a fluid (using centrifugal force B22F 9/10)}
		2009/0824	. . . . . {with a specific atomising fluid}
		2009/0828	. . . . . {with water}

2009/0832	. . . . .	{Handling of atomising fluid, e.g. heating, cooling, cleaning, recirculating}	2202/03	. Treatment under cryogenic or supercritical conditions
2009/0836	. . . . .	{with electric or magnetic field or induction}	2202/05	. Use of magnetic field
2009/084	. . . . .	{combination of methods}	2202/06	. Use of electric fields
2009/0844	. . . . .	{in controlled atmosphere}	2202/07	. by induction
2009/0848	. . . . .	{Melting process before atomisation}	2202/09	. Use of non-gravitational conditions
2009/0852	. . . . .	{Electroslag melting}	2202/11	. Use of irradiation
2009/0856	. . . . .	{Skull melting}	2202/13	. Use of plasma
2009/086	. . . . .	{Cooling after atomisation}	2202/15	. Use of fluidised beds
2009/0864	. . . . .	{by oil, other non-aqueous fluid or fluid-bed cooling}	2202/17	. use of centrifugal or vortex forces
2009/0868	. . . . .	{by injection of solid particles in the melt stream}	2203/00	Controlling
2009/0872	. . . . .	{by water}	2203/01	. To-be-deleted with administrative transfer to B22F 2203/00
2009/0876	. . . . .	{by gas}	2203/03	. for feed-back
2009/088	. . . . .	{Fluid nozzles, e.g. angle, distance}	2203/05	. thermal expansion
2009/0884	. . . . .	{Spiral fluid}	2203/11	. temperature, temperature profile
2009/0888	. . . . .	{casting construction of the melt process, apparatus, intermediate reservoir, e.g. tundish, devices for temperature control}	2203/13	. pressure
2009/0892	. . . . .	{casting nozzle; controlling metal stream in or after the casting nozzle}	2203/15	. weight
2009/0896	. . . . .	{particle transport, separation: process and apparatus}	2207/00	Aspects of the compositions, gradients
9/10	. . . . .	using centrifugal force	2207/01	. Composition gradients
9/12	. . . . .	starting from gaseous material	2207/03	. . of the metallic binder phase in cermets
9/14	. . . . .	using electric discharge	2207/05	. . . eta-phase
9/16	. . . . .	using chemical processes	2207/07	. . Particles with core-rim gradient
2009/165	. . . . .	{Chemical reaction in an Ionic Liquid [IL] (B22F 2009/245 takes precedence)}	2207/11	. Gradients other than composition gradients, e.g. size gradients
9/18	. . . . .	with reduction of metal compounds	2207/13	. . Size gradients
9/20	. . . . .	starting from solid metal compounds	2207/15	. . Temperature gradients
9/22	. . . . .	using gaseous reductors	2207/17	. . density or porosity gradients
9/24	. . . . .	starting from liquid metal compounds, e.g. solutions	2207/20	. Cooperating components
2009/245	. . . . .	{Reduction reaction in an Ionic Liquid [IL]}	2301/00	Metallic composition of the powder or its coating
9/26	. . . . .	using gaseous reductors	2301/05	. Light metals
9/28	. . . . .	starting from gaseous metal compounds	2301/052	. . Aluminium
9/30	. . . . .	with decomposition of metal compounds, e.g. by pyrolysis	2301/054	. . Alkali metals, i.e. Li, Na, K, Rb, Cs, Fr
9/305	. . . . .	{of metal carbonyls}	2301/056	. . Alkaline metals, i.e. Ca, Sr, Ba, Ra
2201/00	Treatment under specific atmosphere		2301/058	. . Magnesium
2201/01	. Reducing atmosphere		2301/10	. Copper
2201/013	. . Hydrogen		2301/15	. Nickel or cobalt
2201/016	. . NH ₃		2301/155	. . Rare Earth - Co or -Ni intermetallic alloys
2201/02	. Nitrogen		2301/20	. Refractory metals
2201/03	. Oxygen		2301/205	. . Titanium, zirconium or hafnium
2201/04	. CO or CO ₂		2301/25	. Noble metals, i.e. Ag Au, Ir, Os, Pd, Pt, Rh, Ru
2201/05	. Water or water vapour		2301/255	. . Silver or gold
2201/10	. Inert gases		2301/30	. Low melting point metals, i.e. Zn, Pb, Sn, Cd, In, Ga
2201/11	. . Argon		2301/35	. Iron
2201/12	. . Helium		2301/355	. . Rare Earth - Fe intermetallic alloys
2201/20	. Use of vacuum		2301/40	. Intermetallics other than rare earth-Co or -Ni or -Fe intermetallic alloys
2201/30	. Carburising atmosphere		2301/45	. Rare earth metals, i.e. Sc, Y, Lanthanides (57-71)
2201/32	. Decarburising atmosphere		2302/00	Metal Compound, non-Metallic compound or non-metal composition of the powder or its coating
2201/40	. Metal compounds		2302/05	. Boride
2201/50	. air		2302/10	. Carbide
2202/00	Treatment under specific physical conditions		2302/105	. . Silicium carbide (SiC)
2202/01	. Use of vibrations		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)

B22F

- 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