

# 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](#)

<b>1/00</b>	<b>Special treatment of metallic powder, e.g. to facilitate working, to improve properties</b> {(treatment of powder by mechanical means, e.g. by grinding, milling, rolling <a href="#">B22F 9/04</a> ); <b>Metallic powders per se, e.g. mixtures of particles of different composition</b> ( <a href="#">C04</a> , <a href="#">C08</a> take precedence; {amorphous powder <a href="#">B22F 9/002</a> )}	<b>1/0074</b>	. . . {Organic materials comprising a solvent, e.g. for slip casting}
		<b>1/0077</b>	. . . {Mixtures obtained by warm mixing}
		<b>1/0081</b>	. {Special treatment of metallic powder, e.g. to facilitate working, to improve properties (coating with organic material <a href="#">B22F 1/0062</a> )}
		<b>1/0085</b>	. . {Thermal or thermo-mechanical treatment}
<b>1/0003</b>	. {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 <a href="#">C22C 33/0207</a> )}	<b>1/0088</b>	. . {Chemical treatment, e.g. passivation}
<b>1/0007</b>	. . {Metallic powder characterised by its shape or structure, e.g. fibre structure}	<b>2001/0092</b>	. . . {Making a dispersion}
<b>1/0011</b>	. . . {Metallic powder characterised by size or surface area only}	<b>1/0096</b>	. . {Treatment resulting in the production of agglomerates}
<b>1/0014</b>	. . . . {by size mixtures or distribution}	<b>1/02</b>	. comprising coating of the powder {(coating with organic material <a href="#">B22F 1/0062</a> ; chemical surface treatment <a href="#">B22F 1/0088</a> )}
<b>1/0018</b>	. . . . {Nanometer sized particles}	<b>1/025</b>	. . {Metallic coating}
<b>1/0022</b>	. . . . . {Dispersions or suspensions thereof}	<b>3/00</b>	<b>Manufacture of workpieces or articles from metallic powder characterised by the manner of compacting or sintering; Apparatus specially adapted therefor; (Presses and furnaces)</b>
<b>1/0025</b>	. . . . . {Nanofibres or nanotubes}	<b>3/001</b>	. {Starting from powder comprising reducible metal compounds (making ferrous alloys starting from compounds <a href="#">C22C 33/0235</a> )}
<b>2001/0029</b>	. . . . . {Hollow particles, including tubes and shells}	<b>3/002</b>	. {Manufacture of articles essentially made from metallic fibres}
<b>2001/0033</b>	. . . . . {Flake form nanoparticles}	<b>3/003</b>	. {Apparatus, e.g. furnaces (in general <a href="#">F27B</a> )}
<b>2001/0037</b>	. . . . . {Complex form nanoparticles, e.g.. prism, pyramid, octahedron}	<b>3/004</b>	. {Filling molds with powder (feeding material to presses in general <a href="#">B30B 15/302</a> )}
<b>1/004</b>	. . . {Fibre structure ( <a href="#">B22F 1/0025</a> takes precedence)}	<b>3/005</b>	. {Loading or unloading powder metal objects (transport in general <a href="#">B65G</a> )}
<b>1/0044</b>	. . . {Nanometer size structures}	<b>3/006</b>	. {Amorphous articles}
<b>1/0048</b>	. . . {Spherical powder}	<b>3/007</b>	. . {by diffusion starting from non-amorphous articles prepared by powder metallurgy}
<b>1/0051</b>	. . . . {Hollow particles}	<b>3/008</b>	. {Selective deposition modelling ( <a href="#">B22F 3/1055</a> takes precedence)}
<b>1/0055</b>	. . . {Flake form powders}	<b>3/02</b>	. Compacting only
<b>1/0059</b>	. . {Metallic powders mixed with a lubricating or binding agent or organic material}	<b>2003/023</b>	. . {Lubricant mixed with the metal powder}
<b>1/0062</b>	. . . {Powders coated with organic material}	<b>2003/026</b>	. . {Mold wall lubrication or article surface lubrication}
<b>2001/0066</b>	. . . {Organic binder comprising a mixture or obtained by reaction of more than one component other than solvent, lubricant}		
<b>1/007</b>	. . . {Non-organic or metal salt binders or lubricants}		

- 3/03 . . Press-moulding apparatus therefor
- 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 sublimatable 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 <a href="#">C22C 1/058</a> )}	7/06	. of composite workpieces or articles from parts, e.g. to form tipped tools {( <a href="#">B22F 7/002</a> takes precedence)}
3/24	. After-treatment of workpieces or articles {( <a href="#">B22F 3/1146</a> 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 {( <a href="#">B22F 7/062</a> takes precedence)}
2003/247	. . {Removing material: carving, cleaning, grinding, hobbing, honing, lapping, polishing, milling, shaving, skiving, turning the surface}	<b>8/00</b>	<b>Manufacture of articles from scrap or waste metal particles</b>
2003/248	. . {Thermal after-treatment}	<b>9/00</b>	<b>Making metallic powder or suspensions thereof</b>
3/26	. . Impregnating {(making ferrous alloys by impregnation <a href="#">C22C 33/0242</a> )}	2009/001	. {from scrap particles}
<b>5/00</b>	<b>Manufacture of workpieces or articles from metallic powder characterised by the special shape of the product</b>	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 ( <a href="#">B22F 5/085</a> 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 ( <a href="#">B22F 3/1103</a> takes precedence; by using pressure rollers only see <a href="#">B22F 3/18</a> )}	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 <a href="#">B22F 5/02</a> )}	9/04	. . starting from solid material, e.g. by crushing, grinding or milling ({ <a href="#">C22C 1/1084</a> takes precedence}; crushing, grinding or milling, in general, see the relevant subclasses, e.g. <a href="#">B02C</a> )}
5/009	. {of turbine components other than turbine blades (of turbine blades <a href="#">B22F 5/04</a> )}	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 <a href="#">B22F 5/10</a> )}	9/06	. . starting from liquid material
<b>7/00</b>	<b>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 <a href="#">C23C</a>)}</b>	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 <a href="#">B22F 9/14</a> )
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 {( <a href="#">B22F 7/002</a> 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 <a href="#">B22F 9/10</a> )}
		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}	<b>2203/00</b>	<b>Controlling</b>
2009/0872	. . . . .	{by water}	2203/01	. To-be-deleted with administrative transfer to <a href="#">B22F 2203/00</a>
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}	<b>2207/00</b>	<b>Aspects of the compositions, gradients</b>
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] ( <a href="#">B22F 2009/245</a> 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]}	<b>2301/00</b>	<b>Metallic composition of the powder or its coating</b>
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
<b>2201/00</b>	<b>Treatment under specific atmosphere</b>		2301/058	. . Magnesium
2201/01	. Reducing atmosphere		2301/10	. Copper
2201/013	. . Hydrogen		2301/15	. Nickel or cobalt
2201/016	. . NH <sub>3</sub>		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 <sub>2</sub>		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		<b>2302/00</b>	<b>Metal Compound, non-Metallic compound or non-metal composition of the powder or its coating</b>
2201/40	. Metal compounds		2302/05	. Boride
2201/50	. air		2302/10	. Carbide
<b>2202/00</b>	<b>Treatment under specific physical conditions</b>		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 <sub>2</sub> O <sub>3</sub> )
			2302/256	. . Silicium oxide (SiO <sub>2</sub> )

- 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**