

# 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 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> )}	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 <a href="#">C22C 33/0207</a> )}	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 <a href="#">B22F 1/0062</a> )}
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 <a href="#">B22F 1/0062</a> ; chemical surface treatment <a href="#">B22F 1/0088</a> )}
2001/0037	. . . . . {Complex form nanoparticles, e.g.. prism, pyramid, octahedron}	1/025	. . {Metallic coating}
1/004	. . . {Fibre structure ( <a href="#">B22F 1/0025</a> takes precedence)}	<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>
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 <a href="#">C22C 33/0235</a> )}
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 <a href="#">F27B</a> )}	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 <a href="#">B30B 15/302</a> )}	2003/1059	. . . . . {for cleaning or recycling}
3/005	. {Loading or unloading powder metal objects (transport in general <a href="#">B65G</a> )}	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 ( <a href="#">B22F 3/1055</a> takes precedence)}	3/1109	. . . . {Inhomogenous pore distribution (composite layers of porous nature <a href="#">B22F 7/002</a> )}
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 <a href="#">B22F 3/1121</a> )}
3/06	. . by centrifugal forces	3/1137	. . . . {by coating porous removable preforms}
3/08	. . by explosive forces {(generating shock waves in general <a href="#">G10K 15/043</a> )}	3/114	. . . {the porous products being formed by impregnation ( <a href="#">B22F 3/1137</a> , <a href="#">B22F 3/26</a> 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 ( <a href="#">B22F 3/114</a> 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 <a href="#">B22F 3/17</a> )
3/1007	. . . {Atmosphere ( <a href="#">B22F 3/1021</a> 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 ( <a href="#">B22F 3/101</a> takes precedence)}	3/1233	. . . . {Organic material}
3/1021	. . . {Removal of binder or filler (removal of binder from ceramics <a href="#">C04B 35/638</a> )}	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 ( <a href="#">B22F 3/001</a> , <a href="#">B22F 3/23</a> 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 ( <a href="#">B22F 3/11</a> takes precedence) {; by ultrasonic bonding ( <a href="#">B22F 3/115</a> 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 <a href="#">B29C 64/153</a> )}	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 <a href="#">B22F 5/10</a> )}
3/172	. . {Continuous compaction, e.g. rotary hammering (with axial pressure and without reduction of section <a href="#">B22F 3/204</a> )}	<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>
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 {( <a href="#">B22F 7/002</a> 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 {( <a href="#">B22F 7/002</a> 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 <a href="#">C22C 1/058</a> )}	2007/068	. . . {repairing articles}
3/24	. After-treatment of workpieces or articles {( <a href="#">B22F 3/1146</a> takes precedence)}	7/08	. . with one or more parts not made from powder {( <a href="#">B22F 7/062</a> takes precedence)}
2003/241	. . {Chemical after-treatment on the surface}	<b>8/00</b>	<b>Manufacture of articles from scrap or waste metal particles</b>
2003/242	. . . {Coating}	<b>9/00</b>	<b>Making metallic powder or suspensions thereof</b>
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 <a href="#">C22C 33/0242</a> )}	9/007	. . {Transformation of amorphous into microcrystalline state}
<b>5/00</b>	<b>Manufacture of workpieces or articles from metallic powder characterised by the special shape of the product</b>	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 ( <a href="#">B22F 5/085</a> takes precedence)}	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> }
2005/005	. {Article surface comprising protrusions}	2009/041	. . . {by mechanical alloying, e.g. blending, milling}
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> )}	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 <a href="#">B22F 5/02</a> )}	2009/044	. . . {by jet milling}
5/009	. {of turbine components other than turbine blades (of turbine blades <a href="#">B22F 5/04</a> )}	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 ( <a href="#">using electric discharge B22F 9/14</a> )	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 <sub>2</sub>
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 ( <a href="#">using centrifugal force B22F 9/10</a> )}	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}	<b>2202/00</b>	<b>Treatment under specific physical conditions</b>
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}	<b>2203/00</b>	<b>Controlling</b>
2009/0896	. . . . . {particle transport, separation: process and apparatus}	2203/01	. To-be-deleted with administrative transfer to <a href="#">B22F 2203/00</a>
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] ( <a href="#">B22F 2009/245 takes precedence</a> )}	2203/15	. weight
9/18	. . with reduction of metal compounds	<b>2207/00</b>	<b>Aspects of the compositions, gradients</b>
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
<b>2201/00</b>	<b>Treatment under specific atmosphere</b>	2207/20	. Cooperating components
2201/01	. Reducing atmosphere	<b>2301/00</b>	<b>Metallic composition of the powder or its coating</b>
2201/013	. . Hydrogen	2301/05	. Light metals
2201/016	. . NH <sub>3</sub>	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<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**