

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 <i>per se</i> ; 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}
- 3/003 . {Apparatus, e.g. furnaces (in general [F27B](#))}
- 3/004 . {Filling molds with powder (feeding material to presses in general [B30B 15/302](#))}
- 3/005 . {Loading or unloading powder metal objects (transport in general [B65G](#))}
- 3/006 . {Amorphous articles}
- 3/007 . . {by diffusion starting from non-amorphous articles prepared by powder metallurgy}
- 3/008 . {Selective deposition modelling ([B22F 3/1055](#) takes precedence)}
- 3/02 . Compacting only
- 2003/023 . . {Lubricant mixed with the metal powder}
- 2003/026 . . {Mold wall lubrication or article surface lubrication}
- 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 64/153](#))}
- 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}
- 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](#))}**
- 7/002 . . {of porous nature}
- 7/004 . . {comprising at least one non-porous part}
- 7/006 {the porous part being obtained by foaming}
- 7/008 . . {characterised by the composition}
- 7/02 . . 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}
- 2009/049 {by pulverising at particular temperature}
- 9/06 . . starting from liquid material
- 2009/065 {Melting inside a liquid, e.g. making spherical balls}

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- 9/08 . . . by casting, e.g. through sieves or in water, by atomising or spraying ([using electric discharge B22F 9/14](#))
- 2009/0804 {Dispersion in or on liquid, other than with sieves}
- 2009/0808 {Mechanical dispersion of melt, e.g. by sieves}
- 2009/0812 {Pulverisation with a moving liquid coolant stream, by centrifugally rotating stream}
- 2009/0816 {by casting with pressure or pulsating pressure on the metal bath}
- 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}
- 2009/0836 {with electric or magnetic field or induction}
- 2009/084 {combination of methods}
- 2009/0844 {in controlled atmosphere}
- 2009/0848 {Melting process before atomisation}
- 2009/0852 {Electroslag melting}
- 2009/0856 {Skull melting}
- 2009/086 {Cooling after atomisation}
- 2009/0864 {by oil, other non-aqueous fluid or fluid-bed cooling}
- 2009/0868 {by injection of solid particles in the melt stream}
- 2009/0872 {by water}
- 2009/0876 {by gas}
- 2009/088 {Fluid nozzles, e.g. angle, distance}
- 2009/0884 {Spiral fluid}
- 2009/0888 {casting construction of the melt process, apparatus, intermediate reservoir, e.g. tundish, devices for temperature control}
- 2009/0892 {casting nozzle; controlling metal stream in or after the casting nozzle}
- 2009/0896 {particle transport, separation: process and apparatus}
- 9/10 using centrifugal force
- 9/12 . . . starting from gaseous material
- 9/14 . . . using electric discharge
- 9/16 . . . using chemical processes
- 2009/165 . . . {Chemical reaction in an Ionic Liquid [IL] ([B22F 2009/245 takes precedence](#))}
- 9/18 . . . with reduction of metal compounds
- 9/20 . . . starting from solid metal compounds
- 9/22 . . . using gaseous reductors
- 9/24 . . . starting from liquid metal compounds, e.g. solutions
- 2009/245 {Reduction reaction in an Ionic Liquid [IL]}
- 9/26 . . . using gaseous reductors
- 9/28 . . . starting from gaseous metal compounds
- 9/30 . . . with decomposition of metal compounds, e.g. by pyrolysis
- 9/305 . . . {of metal carbonyls}
- 2201/00 Treatment under specific atmosphere**
- 2201/01 . Reducing atmosphere
- 2201/013 . . Hydrogen
- 2201/016 . . NH₃

- 2201/02 . Nitrogen
- 2201/03 . Oxygen
- 2201/04 . CO or CO₂
- 2201/05 . Water or water vapour
- 2201/10 . Inert gases
- 2201/11 . . Argon
- 2201/12 . . Helium
- 2201/20 . Use of vacuum
- 2201/30 . Carburising atmosphere
- 2201/32 . Decarburising atmosphere
- 2201/40 . Metal compounds
- 2201/50 . air
- 2202/00 Treatment under specific physical conditions**
- 2202/01 . Use of vibrations
- 2202/03 . Treatment under cryogenic or supercritical conditions
- 2202/05 . Use of magnetic field
- 2202/06 . Use of electric fields
- 2202/07 . by induction
- 2202/09 . Use of non-gravitational conditions
- 2202/11 . Use of irradiation
- 2202/13 . Use of plasma
- 2202/15 . Use of fluidised beds
- 2202/17 . use of centrifugal or vortex forces
- 2203/00 Controlling**
- 2203/01 . To-be-deleted with administrative transfer to [B22F 2203/00](#)
- 2203/03 . for feed-back
- 2203/05 . thermal expansion
- 2203/11 . temperature, temperature profile
- 2203/13 . pressure
- 2203/15 . weight
- 2207/00 Aspects of the compositions, gradients**
- 2207/01 . Composition gradients
- 2207/03 . . of the metallic binder phase in cermets
- 2207/05 . . . eta-phase
- 2207/07 . . Particles with core-rim gradient
- 2207/11 . Gradients other than composition gradients, e.g. size gradients
- 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

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- 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**