### BPERFORMING 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:

<table>
<thead>
<tr>
<th>IPC Group</th>
<th>CPC Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>B22F 3/035</td>
<td>covered by</td>
</tr>
</tbody>
</table>

### 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 9/004]); Metallic powders per se, e.g. mixtures of particles of different composition ([C04, C08 take precedence]; amorphous powder [B22F 9/002])

<table>
<thead>
<tr>
<th>IPC Group</th>
<th>CPC Group</th>
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<tbody>
<tr>
<td>1/003</td>
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<td>1/007</td>
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<td>1/011</td>
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<td>2001/0037</td>
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<td>1/0044</td>
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<td>1/0048</td>
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<td>1/0051</td>
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<td>1/0055</td>
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</tbody>
</table>

- [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])]  
- [Metallic powder characterised by its shape or structure, e.g. fibre structure]  
- [Metallic powder characterised by size or surface area only]  
- [by size mixtures or distribution]  
- [Nanometer sized particles]  
- [Dispersions or suspensions thereof]  
- [Nanofibres or nanotubes]  
- [Hollow particles, including tubes and shells]  
- [Flake form nanoparticles]  
- [Complex form nanoparticles, e.g., prism, pyramid, octahedron]  
- [Fibre structure ([B22F 1/0025 takes precedence])]  
- [Nanometer size structures]  
- [Spherical powder]  
- [Hollow particles]  
- [Flake form powders]

<table>
<thead>
<tr>
<th>IPC Group</th>
<th>CPC Group</th>
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<tbody>
<tr>
<td>1/0059</td>
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<tr>
<td>1/0062</td>
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<tr>
<td>2001/0066</td>
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<td>1/007</td>
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<td>1/0074</td>
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<td>1/0088</td>
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<td>2001/0092</td>
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<td>1/0096</td>
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<td>1/02</td>
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<td>1/025</td>
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</table>

### 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

<table>
<thead>
<tr>
<th>IPC Group</th>
<th>CPC Group</th>
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<tbody>
<tr>
<td>3/001</td>
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</table>

- [Starting from powder comprising reducible metal compounds (making ferrous alloys starting from compounds [C22C 33/0235])]

### WARNING

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>B22F 3/035</td>
<td>covered by</td>
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</tbody>
</table>

1/0095 . . . [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]  
1/007 . . . [Non-organic or metal salt binders or lubricants]  
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]  
1/0088 . . . [Chemical treatment, e.g. passivation]  
2001/0092 . . . [Making a dispersion]  
1/0096 . . . [Treatment resulting in the production of agglomerates]  
1/02 . . . [comprising coating of the powder {coating with organic material [B22F 1/0062]; chemical surface treatment [B22F 1/0088]}]  
1/025 . . . [Metallic coating]  
3/001 . . . [Manufacture of workpieces or articles from metallic powder characterised by the manner of compacting or sintering; Apparatus specially adapted therefor]  
4/001 . . . [Presses and furnaces]  
3/001 . . . [Starting from powder comprising reducible metal compounds (making ferrous alloys starting from compounds [C22C 33/0235])]
takes { 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}
2003/0104 . {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}
2003/0132 . {comprising a grain growth inhibitor}
3/1035 . {Liquid phase sintering}
3/1039 . {by reaction (B22F 3/001, B22F 3/23 take precedence)}
2003/0142 . {with support for articles to be sintered}
2003/0146 . {with separating means for articles to be sintered}
3/105 . by using electric current (other than for infrared 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 . {by 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}
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]
2005/003  [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]
2005/006  [of flat products, e.g. sheets (B22F 3/103 takes precedence; by using pressure rollers only see B22F 3/18)]
2005/007  [of moulds]
2005/008  [of engine cylinder parts or of piston parts other than piston rings (of piston rings B22F 5/02)]
2005/009  [of turbine components other than turbine blades (of turbine blades B22F 5/04)]
2005/009  [of turbine blades]
2005/010  [of threaded articles, e.g. nuts]
2005/011  [of toothed articles, e.g. gear wheels; of cam discs]
2005/012  [with helical contours]
2005/013  [of articles with cavities or holes, not otherwise provided for in the preceding subgroups]
2005/014  [Cavity made by removal of insert]
Treatment under specific atmosphere

2201/00

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 reducers
9/24 . . . starting from liquid metal compounds, e.g. solutions
2009/245 . . . [Reduction reaction in an Ionic Liquid [IL]
9/26 . . . using gaseous reducers
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 . . . Carburing atmosphere
2201/32 . . . Decarburing 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
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tr>
<td>2301/355</td>
<td>Rare Earth - Fe intermetallic alloys</td>
</tr>
<tr>
<td>2301/40</td>
<td>Intermetallics other than rare earth-Co or -Ni or -Fe intermetallic alloys</td>
</tr>
<tr>
<td>2301/45</td>
<td>Rare earth metals, i.e. Sc, Y, Lanthanides (57-71)</td>
</tr>
<tr>
<td>2302/00</td>
<td>Metal Compound, non-Metallic compound or non-metal composition of the powder or its coating</td>
</tr>
<tr>
<td>2302/05</td>
<td>Boride</td>
</tr>
<tr>
<td>2302/10</td>
<td>Carbide</td>
</tr>
<tr>
<td>2302/105</td>
<td>Silicium carbide ($\text{SiC}$)</td>
</tr>
<tr>
<td>2302/15</td>
<td>Carbonitride</td>
</tr>
<tr>
<td>2302/20</td>
<td>Nitride</td>
</tr>
<tr>
<td>2302/25</td>
<td>Oxide</td>
</tr>
<tr>
<td>2302/253</td>
<td>Aluminum oxide ($\text{Al}_2\text{O}_3$)</td>
</tr>
<tr>
<td>2302/256</td>
<td>Silicium oxide ($\text{SiO}_2$)</td>
</tr>
<tr>
<td>2302/30</td>
<td>Oxynitride</td>
</tr>
<tr>
<td>2302/35</td>
<td>Complex boride, carbide, carbonitride, nitride, oxide or oxynitride</td>
</tr>
<tr>
<td>2302/40</td>
<td>Carbon, graphite</td>
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<tr>
<td>2302/403</td>
<td>Carbon nanotube</td>
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<tr>
<td>2302/406</td>
<td>Diamond</td>
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<tr>
<td>2302/45</td>
<td>Others, including non-metals</td>
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<tr>
<td>2303/00</td>
<td>Functional details of metal or compound in the powder or product,</td>
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<td>2303/01</td>
<td>Main component</td>
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<td>Compulsory alloy component</td>
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<td>Optional alloy component</td>
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<tr>
<td>2303/15</td>
<td>Intermetallic</td>
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<tr>
<td>2303/20</td>
<td>Coating by means of particles</td>
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<tr>
<td>2303/25</td>
<td>Coating by means of fibres</td>
</tr>
<tr>
<td>2303/30</td>
<td>Coating alloy</td>
</tr>
<tr>
<td>2303/35</td>
<td>Molten metal infiltrating a metal preform</td>
</tr>
<tr>
<td>2303/40</td>
<td>Layer in a composite stack of layers, workpiece or article</td>
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<tr>
<td>2303/405</td>
<td>Support layer</td>
</tr>
<tr>
<td>2303/45</td>
<td>Part of a final mixture to be processed further</td>
</tr>
<tr>
<td>2304/00</td>
<td>Physical aspects of the powder</td>
</tr>
<tr>
<td>2304/05</td>
<td>Submicron size particles</td>
</tr>
<tr>
<td>2304/052</td>
<td>Particle size below 1nm</td>
</tr>
<tr>
<td>2304/054</td>
<td>Particle size between 1 and 100 nm</td>
</tr>
<tr>
<td>2304/056</td>
<td>Particle size above 100 nm up to 300 nm</td>
</tr>
<tr>
<td>2304/058</td>
<td>Particle size above 300 nm up to 1 micrometer</td>
</tr>
<tr>
<td>2304/10</td>
<td>Micron size particles, i.e. above 1 micrometer up to 500 micrometer</td>
</tr>
<tr>
<td>2304/15</td>
<td>Millimeter size particles, i.e. above 500 micrometer</td>
</tr>
<tr>
<td>2998/00</td>
<td>Supplementary information concerning processes or compositions relating to powder metallurgy</td>
</tr>
<tr>
<td>2998/10</td>
<td>Processes characterised by the sequence of their steps</td>
</tr>
<tr>
<td>2999/00</td>
<td>Aspects linked to processes or compositions used in powder metallurgy</td>
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