

CPC**COOPERATIVE PATENT CLASSIFICATION****C22C****ALLOYS** (flints [C06C 15/00](#); treatment of alloys [C21D](#), [C22F](#))**NOTES**

1. In this subclass, the following terms or expressions are used with the meanings indicated:
 "alloys" includes also:
 - a. metallic composite materials containing a substantial proportion of fibres or other somewhat larger particles;
 - b. ceramic compositions containing free metal bonded to carbides, diamond, oxides, borides, nitrides or silicides, e.g. cermets, or other metal compounds, e.g. oxynitrides or sulfides, other than as macroscopic reinforcing agents;
 "based on" requires at least 50% by weight of the specified constituent or of the specified group of constituents.
2. In the absence of an indication to the contrary, in groups [C22C 5/00](#) to [C22C 32/00](#) an alloy is classified in the last appropriate place.
3. In this subclass it is desirable to classify the individual aspects of combinations of processes or materials for powder metallurgy using Combination Sets with symbols chosen from groups [C22C 1/00](#) to [C22C 43/00](#) or from groups [B22F 1/00](#) to [B22F 9/00](#).
4. In this subclass the special database "ALLOYS" is used. This system includes patent documents classified in groups [C22C 1/04](#) and [C22C 5/00](#) to [C22C 49/14](#) and provides information on the composition of the alloys, their uses and characteristics.

Non-ferrous alloys, i.e. alloys based essentially on metals other than iron (master alloys for iron and steel [C22C 35/00](#); alloys containing radioactive material [C22C 43/00](#); amorphous alloys [C22C 45/00](#); alloys containing fibres or filaments [C22C 47/00](#), [C22C 49/00](#))

C22C 1/00

Making alloys (powder-metallurgical apparatus or processes, not specially modified for making alloys [B22F](#); by electrothermal methods [C22B 4/00](#); by electrolysis [C25C](#))

- [C22C 1/002](#) . {Making amorphous alloys (processes for making amorphous material by powder metallurgy [B22F](#))}
- [C22C 1/005](#) . {Making alloys with holding in the range of the solid-liquid phase}
- [C22C 1/007](#) . {Preparing arsenides or antimonides, especially of the III-VI-compound type, e.g. aluminium or gallium arsenide}
- [C22C 1/02](#) . by melting {([C22C 1/1036](#) takes precedence)}
- [C22C 1/023](#) . . {Alloys based on nickel}
- [C22C 1/026](#) . . {Alloys based on aluminium}
- [C22C 1/03](#) . . using master alloys
- [C22C 1/04](#) . by powder metallurgy ([C22C 1/08](#), {[C22C 1/05](#), [C22C 1/10](#), [C22C 32/00](#), [C22C 47/00](#), [C22C 49/00](#)} take precedence)
- [C22C 1/0408](#) . . {Light metal alloys}
- [C22C 1/0416](#) . . . {Aluminium-based alloys}

- C22C 1/0425 . . {Copper-based alloys}
- C22C 1/0433 . . {Nickel- or cobalt-based alloys}
- C22C 1/0441 . . . {Alloys based on intermetallic compounds of the type rare earth - Co, Ni}
- C22C 1/045 . . {Alloys based on refractory metals}
- C22C 1/0458 . . . {Alloys based on titanium, zirconium, hafnium}
- C22C 1/0466 . . {Alloys based on noble metals}
- C22C 1/0475 . . {Impregnated alloys}
- C22C 1/0483 . . {Alloys based on the low melting point metals Zn, Pb, Sn, Cd, In or Ga}
- C22C 1/0491 . . {comprising intermetallic compounds ([C22C 1/0441](#) takes precedence)}
- C22C 1/05 . . Mixtures of metal powder with non-metallic powder ([C22C 1/08](#), [C22C 47/00](#), [C22C 49/00](#) take precedence)
- C22C 1/051 . . . {Making hard metals based on borides, carbides, nitrides, oxides or silicides; Preparation of the powder mixture used as the starting material}
- C22C 1/053 {with in situ forming of the hard compound ([C22C 1/058](#) takes precedence)}
- C22C 1/055 {using carbon}
- C22C 1/056 {using gas}
- C22C 1/058 . . . {by reaction sintering (i.e. gasless reaction starting from a mixture of solid metal compounds)}
- C22C 1/06 . with the use of special agents for refining or deoxidising
- C22C 1/08 . Alloys with open or closed pores {(by powder metallurgy [B22F 3/11](#))}
- C22C 2001/081 . . {Casting porous metals into porous preform skelet without foaming}
- C22C 2001/082 . . . {with removal of the preform}
- C22C 2001/083 . . {Foaming process in molten metal other than by powder metallurgy}
- C22C 2001/085 . . . {with external pressure or pressure buildup to make porous metals}
- C22C 2001/086 . . . {Gas foaming process}
- C22C 2001/087 . . . {after casting in solidified or solidifying metal to make porous metals}
- C22C 2001/088 . . {Foaming process with solid metal other than by powder metallurgy}
- C22C 1/10 . Alloys containing non-metals ({[C22C 1/05](#)}, [C22C 1/08](#), {[C22C 47/00](#), [C22C 49/00](#)} take precedence)
- C22C 1/1005 . . {Pretreatment of the non-metallic additives (pretreatment of non-metallic fibres [C22C 47/02](#))}

WARNING

Groups [C22C 1/1005](#), [C22C 1/101](#) and [C22C 1/1015](#) are not complete, see also [C22C 1/10](#)

- C22C 1/101 . . . {by coating}
- C22C 1/1015 . . . {by preparing or treating a non-metallic additive preform}
- C22C 2001/1021 {the preform being ceramic}
- C22C 1/1026 . . {starting from a solution or a suspension of (a) compound(s) of at least one of the alloy constituents}
- C22C 1/1031 . . {starting from (a) gaseous compound(s) or (a) vapour(s) of at least one of the constituents}

- C22C 1/1036 . . {starting from a melt (infiltration of sintered ceramic preforms with molten metal [C04B 41/51](#))}
- C22C 1/1042 . . . {by atomising (atomising molten metal [B22F 9/08](#))}
- C22C 2001/1047 . . . {by mixing and casting liquid metal matrix composites}
- C22C 2001/1052 {by mixing and casting metal matrix composites with reaction}
- C22C 2001/1057 . . . {Reactive infiltration}
- C22C 2001/1063 {Gas reaction, e.g. lanxide}
- C22C 1/1068 . . . {Making hard metals based on borides, carbides, nitrides, oxides, silicides}
- C22C 2001/1073 . . . {Infiltration or casting under mechanical pressure, e.g. squeeze casting}
- C22C 1/1078 . . {by internal oxidation of material in solid state}
- C22C 1/1084 . . {by mechanical alloying (blending, milling)}
- C22C 2001/1089 . . {by partial reduction or decomposition of a solid metal compound}
- C22C 1/1094 . . {comprising an after-treatment}

NOTE

Documents classified in group [C22C 1/1094](#) are also classified in subclass [C22F](#)

C22C 3/00 **Removing material from alloys to produce alloys of different constitution {separation of the constituents of alloys}**

- C22C 3/005 . {Separation of the constituents of alloys}

C22C 5/00 **Alloys based on noble metals**

- C22C 5/02 . Alloys based on gold
- C22C 5/04 . Alloys based on a platinum group metal
- C22C 5/06 . Alloys based on silver
- C22C 5/08 . . with copper as the next major constituent
- C22C 5/10 . . with cadmium as the next major constituent

C22C 7/00 **Alloys based on mercury**

C22C 9/00 **Alloys based on copper**

- C22C 9/01 . with aluminium as the next major constituent
- C22C 9/02 . with tin as the next major constituent
- C22C 9/04 . with zinc as the next major constituent
- C22C 9/05 . with Magnese as the next major constituent
- C22C 9/06 . with nickel or cobalt as the next major constituent
- C22C 9/08 . with lead as the next major constituent
- C22C 9/10 . with silicon as the next major constituent

C22C 11/00 **Alloys based on lead**

- C22C 11/02 . with an alkali or an alkaline earth metal as the next major constituent

C22C 11/04	• with copper as the next major constituent
C22C 11/06	• with tin as the next major constituent
C22C 11/08	• with antimony or bismuth as the next major constituent
C22C 11/10	• . with tin
C22C 12/00	Alloys based on antimony or bismuth
C22C 13/00	Alloys based on tin
C22C 13/02	• with antimony or bismuth as the next major constituent
C22C 14/00	Alloys based on titanium
C22C 16/00	Alloys based on zirconium
C22C 18/00	Alloys based on zinc
C22C 18/02	• with copper as the next major constituent
C22C 18/04	• with aluminium as the next major constituent
C22C 19/00	Alloys based on nickel or cobalt
C22C 19/002	• {with copper as the next major constituent}
C22C 19/005	• {with Manganese as the next major constituent}
C22C 19/007	• {with a light metal (alkali metal Li, Na, K, Rb, Cs; earth alkali metal Be, Mg, Ca, Sr, Ba, Al Ga, Ge, Ti) or B, Si, Zr, Hf, Sc, Y, lanthanides, actinides, as the next major constituent}
C22C 19/03	• based on nickel
C22C 19/05	• . with chromium
C22C 19/051	• . . {and Mo or W}
C22C 19/052	• . . . {with the maximum Cr content being at least 40%}
C22C 19/053	• {with the maximum Cr content being at least 30% but less than 40%}
C22C 19/055	• {with the maximum Cr content being at least 20% but less than 30%}
C22C 19/056	• {with the maximum Cr content being at least 10% but less than 20%}
C22C 19/057	• {with the maximum Cr content being less 10%}
C22C 19/058	• . . . {without Mo and W}
C22C 19/07	• based on cobalt
C22C 20/00	Alloys based on cadmium
C22C 21/00	Alloys based on aluminium
C22C 21/003	• {containing at least 2.6% of one or more of the following elements. Sn, Pb, Sb, Bi, Cd, T}
C22C 21/006	• {containing Hg}
C22C 21/02	• with silicon as the next major constituent
C22C 21/04	• . Modified aluminium-silicon alloys
C22C 21/06	• with magnesium as the next major constituent

C22C 21/08

- with silicon

C22C 21/10

- with zinc as the next major constituent

C22C 21/12

- with copper as the next major constituent

C22C 21/14

- with silicon

C22C 21/16

- with magnesium

C22C 21/18

- with zinc

C22C 22/00

Alloys based on manganese

C22C 23/00

Alloys based on magnesium

C22C 23/02

- with aluminium as the next major constituent

C22C 23/04

- with zinc or cadmium as the next major constituent

C22C 23/06

- with a rare earth metal as the next major constituent

C22C 24/00

Alloys based on an alkali or an alkaline earth metal

C22C 25/00

Alloys based on beryllium

C22C 26/00

Alloys containing diamond {or cubic or wurtzitic boron nitride, fullerenes or carbon nanotubes}

C22C 2026/001

- {Fullerenes}

C22C 2026/002

- {Carbon nanotubes}

C22C 2026/003

- {Cubic boron nitrides only}

C22C 2026/005

- {with additional metal compounds being borides}

C22C 2026/006

- {with additional metal compounds being carbides}

C22C 2026/007

- {with additional metal compounds being nitrides}

C22C 2026/008

- {with additional metal compounds other than carbides, borides or nitrides}

C22C 27/00

Alloys based on rhenium or a refractory metal not mentioned in groups [C22C 14/00](#) or [C22C 16/00](#)

C22C 27/02

- Alloys based on vanadium, niobium, or tantalum

C22C 27/025

- {alloys based on vanadium}

C22C 27/04

- Alloys based on tungsten or molybdenum

C22C 27/06

- Alloys based on chromium

C22C 28/00

Alloys based on a metal not provided for in groups [C22C 5/00](#) to [C22C 27/00](#)

C22C 29/00

Alloys based on carbides, oxides, nitrides, borides, or silicides, e.g. cermets, or other metal compounds, e.g. oxynitrides, sulfides {([C22C 26/00](#) takes precedence)}

C22C 29/005

- {comprising a particular metallic binder}

C22C 29/02

- based on carbides or carbonitrides

C22C 29/04

- based on carbonitrides

C22C 29/06

- based on carbides, but not containing other metal compounds

- C22C 29/062 . . . {based on B₄C}
- C22C 29/065 . . . {based on SiC}
- C22C 29/067 . . . {comprising a particular metallic binder}
- C22C 29/08 . . . based on tungsten carbide
- C22C 29/10 . . . based on titanium carbide
- C22C 29/12 . based on oxides
- C22C 29/14 . based on borides
- C22C 29/16 . based on nitrides {(containing cubic BN or wurtzitic BN and diamond [C22C 26/00](#))}
- C22C 29/18 . based on silicides

C22C 30/00**Alloys containing less than 50% by weight of each constituent**

- C22C 30/02 . containing copper
- C22C 30/04 . containing tin or lead
- C22C 30/06 . containing zinc

C22C 32/00**Non-ferrous alloys containing at least 5% by weight but less than 50% by weight of oxides, carbides, borides, nitrides, silicides or other metal compounds, e.g. oxynitrides, sulfides whether added as such or formed in situ****NOTE**

This group comprises also dispersion hardened alloys with less than 5% of dispersed compounds

- C22C 32/0005 . {with at least one oxides and at least one of carbides, nitrides, borides or silicides as the main non-metallic constituents}
- C22C 32/001 . {with only oxides}
- C22C 32/0015 . . {with only single oxides as main non-metallic constituents}
- C22C 32/0021 . . . {Matrix based on noble metals, Cu or alloys thereof}
- C22C 32/0026 . . . {Matrix based on Ni, Co, Cr or alloys thereof; Matrix based on Fe for ODS steels (matrix based on Fe for steels other than ODS [C22C 33/00](#), by powder metallurgy [C22C 33/02](#))}
- C22C 32/0031 . . . {Matrix based on refractory metals, W, Mo, Nb, Hf, Ta, Zr, Ti, V or alloys thereof}
- C22C 32/0036 . . . {Matrix based on Al, Mg, Be or alloys thereof}
- C22C 32/0042 . . . {Matrix based on low melting metals, Pb, Sn, In, Zn, Cd or alloys thereof}
- C22C 32/0047 . {with carbides, nitrides, borides or silicides as the main non-metallic constituents}
- C22C 32/0052 . . {only carbides}
- C22C 32/0057 . . . {based on B₄C}
- C22C 32/0063 . . . {based on SiC}
- C22C 32/0068 . . {only nitrides}
- C22C 32/0073 . . {only borides}
- C22C 32/0078 . . {only silicides}

- C22C 32/0084 . {carbon or graphite as the main non-metallic constituent}
- C22C 32/0089 . {with other, not previously mentioned inorganic compounds as the main non-metallic constituent, e.g. sulfides, glass}
- C22C 32/0094 . {with organic materials as the main non-metallic constituent, e.g. resin}

Ferrous alloys, i.e. alloys based on iron (alloys containing radioactive material [C22C 43/00](#); amorphous alloys [C22C 45/00](#); alloys containing fibres or filaments [C22C 47/00](#), [C22C 49/00](#); heat treatment thereof [C21D](#))

C22C 33/00

Making ferrous alloys

- C22C 33/003 . {making amorphous alloys}
- C22C 33/006 . {compositions used for making ferrous alloys}
- C22C 33/02 . by powder metallurgy ([working metallic powder B22F](#))
- C22C 33/0207 . . {Using a mixture of prealloyed powders or a master alloy (mixtures of metal powder in general [B22F 1/0003](#))}
- C22C 33/0214 . . . {comprising P or a phosphorus compound}
- C22C 33/0221 . . . {comprising S or a sulfur compound}
- C22C 33/0228 . . . {comprising other non-metallic compounds or more than 5% of graphite}
- C22C 33/0235 . . {Starting from compounds, e.g. oxides (manufacture of articles starting from powder comprising reducible metal compounds in general [B22F 3/001](#))}
- C22C 33/0242 . . {using the impregnating technique ([impregnating articles in general B22F 3/26](#))}
- C22C 33/025 . . {having an intermetallic of the REM-Fe type which is not magnetic}
- C22C 33/0257 . . {characterised by the range of the alloying elements}
- C22C 33/0264 . . . {the maximum content of each alloying element not exceeding 5%}
- C22C 33/0271 {with only C, Mn, Si, P, S, As as alloying elements, e.g. carbon steel}
- C22C 33/0278 {with at least one alloying element having a minimum content above 5%}
- C22C 33/0285 {with Cr, Co, or Ni having a minimum content higher than 5%}
- C22C 33/0292 {with more than 5% preformed carbides, nitrides or borides}
- C22C 33/04 . by melting
- C22C 33/06 . . using master alloys
- C22C 33/08 . Making cast-iron alloys
- C22C 33/10 . . including procedures for adding magnesium
- C22C 33/12 . . . by fluidised injection

C22C 35/00

Master alloys for iron or steel

- C22C 35/005 . {based on iron, e.g. ferro-alloys}

NOTE

In the absence of an indication to the contrary, in groups [C22C 37/00](#) to [C22C 38/00](#) an alloy is classified in the last appropriate place that provides for one of the alloying components.

C22C 37/00

Cast-iron alloys

- C22C 37/04 . containing spheroidal graphite
- C22C 37/06 . containing chromium
- C22C 37/08 . . with nickel
- C22C 37/10 . containing aluminium or silicon

C22C 38/00**Ferrous alloys, e.g. steel alloys** (cast-iron alloys [C22C 37/00](#))

- C22C 38/001 . {containing N}
- C22C 38/002 . {containing In, Mg, or other elements not provided for in one single group [C22C 38/001](#) to [C22C 38/60](#)}
- C22C 38/004 . {Very low carbon steels, i.e. having a carbon content of less than 0,01%}
- C22C 38/005 . {containing rare earths, i.e. Sc, Y, Lanthanides}
- C22C 38/007 . {containing silver}
- C22C 38/008 . {containing tin}
- C22C 38/02 . containing silicon
- C22C 38/04 . containing manganese
- C22C 38/06 . containing aluminium
- C22C 38/08 . containing nickel {([C22C 38/105](#) takes precedence)}
- C22C 38/10 . containing cobalt
- C22C 38/105 . . {containing Co and Ni}
- C22C 38/12 . containing tungsten, tantalum, molybdenum, vanadium, or niobium
- C22C 38/14 . containing titanium or zirconium
- C22C 38/16 . containing copper
- C22C 38/18 . containing chromium
- C22C 38/20 . . with copper
- C22C 38/22 . . with molybdenum or tungsten
- C22C 38/24 . . with vanadium
- C22C 38/26 . . with niobium or tantalum
- C22C 38/28 . . with titanium or zirconium
- C22C 38/30 . . with cobalt
- C22C 38/32 . . with boron
- C22C 38/34 . . with more than 1.5% by weight of silicon
- C22C 38/36 . . with more than 1.7% by weight of carbon
- C22C 38/38 . . with more than 1.5% by weight of manganese
- C22C 38/40 . . with nickel
- C22C 38/42 . . . with copper
- C22C 38/44 . . . with molybdenum or tungsten
- C22C 38/46 . . . with vanadium
- C22C 38/48 . . . with niobium or tantalum
- C22C 38/50 . . . with titanium or zirconium
- C22C 38/52 . . . with cobalt
- C22C 38/54 . . . with boron

- C22C 38/56 . . . with more than 1.7% by weight of carbon
- C22C 38/58 . . . with more than 1.5% by weight of manganese
- C22C 38/60 . containing lead, selenium, tellurium, or antimony, or more than 0.04% by weight of sulfur

C22C 43/00 Alloys containing radioactive materials

C22C 45/00 Amorphous alloys

- C22C 45/001 . {with Cu as the major constituent}
- C22C 45/003 . {with one or more of the noble metals as major constituent}
- C22C 45/005 . {with Mg as the major constituent}
- C22C 45/006 . {with Cr as the major constituent}
- C22C 45/008 . {with Fe, Co or Ni as the major constituent ([C22C 45/02](#), [C22C 45/04](#) take precedence)}
- C22C 45/02 . with Fe as the major constituent
- C22C 45/04 . with Ni or Co as the major constituent
- C22C 45/06 . with Be as the major constituent
- C22C 45/08 . with Al as the major constituent
- C22C 45/10 . with Mo, W, Nb, Ta, Ti or Zr {or Hf} as the major constituent

Alloys containing fibres or filaments

WARNING

The subgroups of [C22C 47/00](#) and [C22C 49/00](#) might be incomplete as some of the patent documents classified [C22C 47/08](#), [C22C 47/16](#) and [C22C 49/00](#) might need reclassification to one or more subgroups or to [C22C 47/02](#) and subgroups

C22C 47/00 Making alloys containing metallic or non-metallic fibres or filaments

- C22C 2047/005 . {Working of filaments or rods into fibre reinforced metal by mechanical deformation}
- C22C 47/02 . Pretreatment of the fibres or filaments
- C22C 47/025 . . {Aligning or orienting the fibres}

WARNING

Not complete, see also [C22C 47/02](#)

- C22C 47/04 . . by coating, e.g. with a protective or activated covering
- C22C 47/06 . . by forming the fibres or filaments into a preformed structure, e.g. using a temporary binder to form a mat-like element
- C22C 47/062 . . . {from wires or filaments only}

WARNING

Groups [C22C 47/062](#), [C22C 47/064](#), [C22C 47/066](#) and [C22C 47/068](#) are not complete, see also [C22C 47/02](#) or [C22C 47/06](#)

- C22C 47/064 {Winding wires}
- C22C 47/066 {Weaving wires}
- C22C 47/068 {Aligning wires}
- C22C 47/08 . by contacting the fibres or filaments with molten metal, e.g. by infiltrating the fibres or filaments placed in a mould {(C22C 47/16 takes precedence)}
- C22C 47/10 . . Infiltration in the presence of a reactive atmosphere; Reactive infiltration
- C22C 47/12 . . Infiltration or casting under mechanical pressure
- C22C 47/14 . by powder metallurgy, i.e. by processing mixtures of metal powder and fibres or filaments
- C22C 47/16 . by thermal spraying of the metal, e.g. plasma spraying {(atomising molten metal comprising fibres see also C22C 1/1042)}
- C22C 47/18 . . using a preformed structure of fibres or filaments
- C22C 47/20 . by subjecting to pressure and heat an assembly comprising at least one metal layer or sheet and one layer of fibres or filaments
- C22C 2047/205 . . {placing wires inside grooves of a metal layer}

C22C 49/00 Alloys containing metallic or non-metallic fibres or filaments

- C22C 49/02 . characterised by the matrix material
- C22C 49/04 . . Light metals
- C22C 49/06 . . . Aluminium
- C22C 49/08 . . Iron group metals
- C22C 49/10 . . Refractory metals
- C22C 49/11 . . . Titanium
- C22C 49/12 . . Intermetallic matrix material
- C22C 49/14 . characterised by the fibres or filaments

C22C 2200/00 Crystalline structure

- C22C 2200/02 . Amorphous
- C22C 2200/04 . Nanocrystalline
- C22C 2200/06 . Quasicrystalline

Non-ferrous alloys, i.e. alloys based essentially on metals other than iron (master alloys for iron and steel C22C 35/00; alloys containing radioactive material C22C 43/00; amorphous alloys C22C 45/00; alloys containing fibres or filaments C22C 47/00, C22C 49/00)

C22C 2202/00 Physical properties

- C22C 2202/02 . Magnetic
- C22C 2202/04 . Hydrogen absorbing

C22C 2204/00 End product comprising different layers, coatings or parts of cermet