CPC  COOPERATIVE PATENT CLASSIFICATION

C  CHEMISTRY; METALLURGY
   (NOTES omitted)

METALLURGY

C23  COATING METALLIC MATERIAL; COATING MATERIAL WITH METALLIC MATERIAL; CHEMICAL SURFACE TREATMENT; DIFFUSION TREATMENT OF METALLIC MATERIAL; COATING BY VACUUM EVAPORATION, BY SPUTTERING, BY ION IMPLANTATION OR BY CHEMICAL VAPOUR DEPOSITION, IN GENERAL; INHIBITING CORROSION OF METALLIC MATERIAL OR INCRUSTATION IN GENERAL
   (NOTES omitted)

C23C  COATING METALLIC MATERIAL; COATING MATERIAL WITH METALLIC MATERIAL; SURFACE TREATMENT OF METALLIC MATERIAL BY DIFFUSION INTO THE SURFACE, BY CHEMICAL CONVERSION OR SUBSTITUTION; COATING BY VACUUM EVAPORATION, BY SPUTTERING, BY ION IMPLANTATION OR BY CHEMICAL VAPOUR DEPOSITION, IN GENERAL (making metal-coated products by extrusion B21C 23/22; covering with metal by connecting pre-existing layers to articles, see the relevant places, e.g. B21D 39/00, B23K; metallising of glass C03C; metallising mortars, concrete, artificial stone, ceramics or natural stone C04B 41/00; enamelling of, or applying a vitreous layer to, metals C23D; treating metal surfaces or coating of metals by electrolysis or electrophoresis C25D; single-crystal film growth C30B; by metallising textiles D06M 11/83; decorating textiles by locally metallising D06Q 1/04)

NOTE
In this subclass, an operation is considered as pre-treatment or after-treatment when it is specially adapted for, but quite distinct from, the coating process concerned and constitutes an independent operation. If an operation results in the formation of a permanent sub- or upper layer, it is not considered as pre-treatment or after-treatment and is classified as a multi-coating process.

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:
C23C 14/36 - C23C 14/44  covered by  C23C 14/34 - C23C 14/358

Coating by applying the coating material in the molten state
   (casting B22D, e.g. B22D 19/08, B22D 23/04, B29; built-up welding B23K, e.g. B23K 5/18, B23K 9/04)

2/00  Hot-dipping or immersion processes for applying the coating material in the molten state without affecting the shape; Apparatus therefor
   2/003  . . [Apparatus, e.g. crucibles, heating devices]
   2/006  . . [Pattern or selective deposit without pre-treatment of the material to be coated]
   2/02  . Pretreatment of the material to be coated, e.g. for coating on selected surface areas (C23C 2/30 takes precedence)
   2/04  . . characterised by the coating material
   2/06  . . Zinc or cadmium or alloys based thereon
   2/08  . . Tin or alloys based thereon
   2/10  . . Lead or alloys based thereon
   2/12  . . Aluminium or alloys based thereon

2/14  . . Removing excess of molten coatings; Controlling or regulating the coating thickness
   2/16  . . using fluids under pressure, e.g. air knives
   2/18  . . Removing excess of molten coatings from elongated material
   2/185  . . . . [Tubes; Wires]
   2/20  . . . . Strips; Plates
   2/22  . . by rubbing, e.g. using knives , e.g. rubbing solids
   2/24  . . using magnetic or electric fields
   2/26  . . After-treatment (C23C 2/14 takes precedence)
   2/265  . . {by applying solid particles to the molten coating}
   2/28  . . Thermal aftertreatment, e.g. treatment in oil bath
   2/285  . . . . [for remelting the coating]
   2/30  . . Fluxes or coverings on molten baths (C23C 2/22 takes precedence)
Coating by applying the coating material in the molten state

4/00 Coating by spraying the coating material in the molten state, e.g. by flame, plasma or electric discharge (build-up welding B23K, e.g. B23K 5/18, B23K 9/04)

4/01 . . . Selective coating, e.g. pattern coating, without pre-treatment of the material to be coated

4/02 . . . Pretreatment of the material to be coated, e.g. for coating on selected surface areas

4/04 . . . characterised by the coating material

4/06 . . . Metallic material

4/067 . . . containing free particles of non-metal elements, e.g. carbon, silicon, boron, phosphorus or arsenic

4/073 . . . containing MCrAI or MCrAlY alloys, where M is nickel, cobalt or iron, with or without non-metal elements

4/08 . . . containing only metal elements (C23C 4/073 takes precedence)

4/10 . . . Oxides, borides, carbides, nitrides or silicides; Mixtures thereof

4/11 . . . Oxides

4/12 . . . characterised by the method of spraying

4/123 . . . Spraying molten metal

4/126 . . . Detonation spraying

4/129 . . . Flame spraying

4/131 . . . Wire arc spraying

4/134 . . . Plasma spraying

4/137 . . . Spraying in vacuum or in an inert atmosphere

4/14 . . . for coating elongate material

4/16 . . . Wires; Tubes

4/18 . . . After-treatment

4/185 . . . [Separation of the coating from the substrate]

6/00 Coating by casting molten material on the substrate

Solid state diffusion into metallic material surfaces

8/00 Solid state diffusion of only non-metal elements into metallic material surfaces (diffusion of silicon C23C 10/00); Chemical surface treatment of metallic material by reaction of the surface with a reactive gas, leaving reaction products of surface material in the coating, e.g. conversion coatings, passivation of metals (C23C 14/00) takes precedence)

8/02 . . . Pretreatment of the material to be coated (C23C 8/04 takes precedence)

8/04 . . . Treatment of selected surface areas, e.g. using masks

8/06 . . . using gases (C23C 8/36 takes precedence)

8/08 . . . only one element being applied

8/10 . . . Oxidising

8/12 . . . using elemental oxygen or ozone

8/14 . . . Oxidising of ferrous surfaces

8/16 . . . using oxygen-containing compounds, e.g. water, carbon dioxide

8/18 . . . Oxidising of ferrous surfaces

8/20 . . . Carburising

8/22 . . . of ferrous surfaces

8/24 . . . Nitriding

8/26 . . . of ferrous surfaces

8/28 . . . more than one element being applied in one step

8/30 . . . Carbo-nitriding

8/32 . . . of ferrous surfaces

8/34 . . . more than one element being applied in more than one step

8/36 . . . using ionised gases, e.g. ionitriding

8/38 . . . Treatment of ferrous surfaces

8/40 . . . using liquids, e.g. salt baths, liquid suspensions

8/42 . . . only one element being applied

8/44 . . . Carburising

8/46 . . . of ferrous surfaces

8/48 . . . Nitriding

8/50 . . . of ferrous surfaces

8/52 . . . more than one element being applied in one step

8/54 . . . Carbo-nitriding

8/56 . . . of ferrous surfaces

8/58 . . . more than one element being applied in more than one step

8/60 . . . using solids, e.g. powders, pastes (using liquid suspensions of solids C23C 8/40)

8/62 . . . only one element being applied

8/64 . . . Carburising

8/66 . . . of ferrous surfaces

8/68 . . . Boronising

8/70 . . . of ferrous surfaces

8/72 . . . more than one element being applied in one step

8/74 . . . Carbo-nitriding

8/76 . . . of ferrous surfaces

8/78 . . . more than one element being applied in more than one step

8/80 . . . After-treatment

10/00 Solid state diffusion of only metal elements or silicon into metallic material surfaces

10/02 . . . Pretreatment of the material to be coated (C23C 10/04 takes precedence)

10/04 . . . Diffusion into selected surface areas, e.g. using masks

10/06 . . . using gases

10/08 . . . only one element being diffused

10/10 . . . Chromising

10/12 . . . of ferrous surfaces

10/14 . . . more than one element being diffused in one step

10/16 . . . more than one element being diffused in more than one step

10/18 . . . using liquids, e.g. salt baths, liquid suspensions

10/20 . . . only one element being diffused

10/22 . . . Metal melt containing the element to be diffused

10/24 . . . Salt bath containing the element to be diffused

10/26 . . . more than one element being diffused

10/28 . . . using solids, e.g. powders, pastes

10/30 . . . using a layer of powder or paste on the surface (using liquid suspensions of solids C23C 10/18)

10/32 . . . Chromising
Coating by vacuum evaporation, by sputtering or by ion implantation

14/00 Coating by vacuum evaporation, by sputtering or by ion implantation of the coating forming material

14/0005 [Separation of the coating from the substrate]
14/001 [Coating on a liquid substrate]
14/0015 [characterized by the colour of the layer]
14/0021 [Reactive sputtering or evaporation]
14/0026 [Activation or excitation of reactive gases outside the coating chamber]
14/0031 [Bombardment of substrates by reactive ion beams]
14/0036 [Reactive sputtering]
14/0042 [Controlling partial pressure or flow rate of reactive or inert gases with feedback of measurements]
14/0047 [Activation or excitation of reactive gases outside the coating chamber]
14/0052 [Bombardment of substrates by reactive ion beams]
14/0057 [using reactive gases other than O₂, H₂O, N₂, NH₃ or CH₄]
14/0063 [characterised by means for introducing or removing gases]
14/0068 [characterised by means for confinement of gases or sputtered material, e.g. screens, baffles]
14/0073 [by exposing the substrates to reactive gases intermittently]
14/0078 [by moving the substrates between spatially separate sputtering and reaction stations]
14/0084 [Producing gradient compositions]
14/0089 [in metallic mode]
14/0094 [in transition mode]
14/02 Pretreatment of the material to be coated (C23C 14/04 takes precedence)
14/021 [Cleaning or etching treatments]
Coating by vacuum evaporation, by sputtering or by ion implantation

Chemical deposition or plating by decomposition; Contact plating
(solid state diffusion C23C 8/00 - C23C 12/00)

16/00 Chemical coating by decomposition of gaseous compounds, without leaving reaction products of surface material in the coating, i.e. chemical vapour deposition (CVD) processes (reactive sputtering or vacuum evaporation C23C 14/00)

16/03 . . . [Coating on a liquid substrate]
16/06 . . . [characterized by the colour of the layer]
16/01 . . . on temporary substrates, e.g. substrates subsequently removed by etching
16/02 . . . Pretreatment of the material to be coated (C23C 16/04 takes precedence)
16/02 . . . [by heating]
16/02 . . . [in a reactive atmosphere (C23C 16/0227 takes precedence)]
16/02 . . . [by cleaning or etching]
16/02 . . . [by etching with a reactive gas]
16/02 . . . [by etching with a plasma]
16/02 . . . [Physical treatment to alter the texture of the surface, e.g. scratching or polishing]
16/02 . . . [Irradiation with laser or particle beam]
16/02 . . . [Deposition of sub-layers, e.g. to promote the adhesion of the main coating]
16/02 . . . [of metallic sub-layers (C23C 16/029 takes precedence)]
16/02 . . . [Graded interfaces]
16/04 . . . Coating on selected surface areas, e.g. using masks
16/04 . . . [using masks]
Chemical deposition or plating by decomposition; Contact plating

16/42 . . . . Silicides
16/44 . . . characterised by the method of coating (C23C 16/04 takes precedence)
16/4401 . . . . (Means for minimising impurities, e.g. dust, moisture or residual gas, in the reaction chamber)
16/4402 . . . . (Reduction of impurities in the source gas)
16/4404 . . . . (Coatings or surface treatment on the inside of the reaction chamber or on parts thereof)
16/4405 . . . . (Cleaning of reactor or parts inside the reactor by using reactive gases)
16/4407 . . . . (Cleaning of reactor or reactor parts by using wet or mechanical methods)
16/4408 . . . . (by purging residual gases from the reaction chamber or gas lines)
16/4409 . . . . (characterised by sealing means)
16/4411 . . . . (Cooling of the reaction chamber walls (C23C 16/45572 takes precedence))
16/4412 . . . . (Details relating to the exhausts, e.g. pumps, filters, scrubbers, particle traps)
16/4414 . . . . (Electrochemical vapour deposition [EVD])
16/4415 . . . . (Acoustic wave CVD)
16/4417 . . . . (Methods specially adapted for coating powder)
16/4418 . . . . (Methods for making free-standing articles (C23C 16/01 takes precedence))
16/442 . . . . using fluidised bed process
16/448 . . . . characterised by the method used for generating reactive gas streams, e.g. by evaporation or sublimation of precursor materials
16/4481 . . . . (by evaporation using carrier gas in contact with the source material (C23C 16/4486 takes precedence))
16/4482 . . . . (by bubbling of carrier gas through liquid source material)
16/4483 . . . . (using a porous body)
16/4485 . . . . (by evaporation without using carrier gas in contact with the source material (C23C 16/4486 takes precedence))
16/4486 . . . . (by producing an aerosol and subsequent evaporation of the droplets or particles)
16/4487 . . . . (by using a condenser)
16/4488 . . . . (by in situ generation of reactive gas by chemical or electrochemical reaction)
16/452 . . . . by activating reactive gas streams before [their] introduction into the reaction chamber, e.g. by [ionisation] or addition of reactive species
16/453 . . . . passing the reaction gases through burners or torches, e.g. atmospheric pressure CVD (C23C 16/513 takes precedence; for flame or plasma spraying of coating material in the molten state C23C 4/00)
16/455 . . . . characterised by the method used for introducing gases into reaction chamber or for modifying gas flows in reaction chamber
16/45502 . . . . (Flow conditions in reaction chamber)
16/45504 . . . . (Laminar flow)
16/45506 . . . . (Turbulent flow)
16/45508 . . . . (Radial flow)
16/4551 . . . . (Jet streams)
16/45512 . . . . (Premixing before introduction in the reaction chamber)
16/45514 . . . . (Mixing in close vicinity to the substrate)
16/45517 . . . . (Confinement of gases to vicinity of substrate)
16/45519 . . . . (Inert gas curtains)
Chemical deposition or plating by decomposition; Contact plating

16/45521 . . . . [the gas, other than thermal contact gas, being introduced the rear of the substrate to flow around its periphery]
16/45523 . . . . [Pulsed gas flow or change of composition over time]
16/45525 . . . . [Atomic layer deposition [ALD]]
16/45527 . . . . [characterized by the ALD cycle, e.g. different flows or temperatures during half-reactions, unusual pulsing sequence, use of precursor mixtures or auxiliary reactants or activations]
16/45529 . . . . {specially adapted for making a layer stack of alternating different compositions or gradient compositions}
16/45531 . . . . {specially adapted for making ternary or higher compositions}
16/45534 . . . . {Use of auxiliary reactants other than used for contributing to the composition of the main film, e.g. catalysts, activators or scavengers}
16/45536 . . . . {Use of plasma, radiation or electromagnetic fields}
16/45538 . . . . {Plasma being used continuously during the ALD cycle}
16/4554 . . . . {Plasma being used non-continuously in between ALD reactions (C23C 16/56 takes precedence)}
16/45542 . . . . {Plasma being used non-continuously during the ALD reactions}
16/45544 . . . . {characterized by the apparatus}
16/45546 . . . . {specially adapted for a substrate stack in the ALD reactor}
16/45548 . . . . {having arrangements for gas injection at different locations of the reactor for each ALD half-reaction}
16/45551 . . . . {for relative movement of the substrate and the gas injectors or half-reaction reactor compartments}
16/45553 . . . . {characterized by the use of precursors specially adapted for ALD}
16/45555 . . . . {applied in non-semiconductor technology}
16/45557 . . . . [Pulsed pressure or control pressure]
16/45559 . . . . [Diffusion of reactive gas to substrate]
16/45561 . . . . [Gas plumbing upstream of the reaction chamber]
16/45563 . . . . [Gas nozzles]
16/45565 . . . . [Shower nozzles]
16/45568 . . . . [Porous nozzles]
16/4557 . . . . [Heated nozzles]
16/45572 . . . . [Cooled nozzles]
16/45574 . . . . [Nozzles for more than one gas]
16/45576 . . . . [Coaxial inlets for each gas]
16/45578 . . . . [Elongated nozzles, tubes with holes]
16/4558 . . . . [Perforated rings]
16/45582 . . . . [Expansion of gas before it reaches the substrate]
16/45585 . . . . [Compression of gas before it reaches the substrate]
16/45587 . . . . [Mechanical means for changing the gas flow]
16/45589 . . . . [Movable means, e.g. fans]
16/45591 . . . . [Fixed means, e.g. wings, baffles]
16/45593 . . . . [Recirculation of reactive gases]
16/45595 . . . . [Atmospheric CVD gas inlets with no enclosed reaction chamber]
16/45597 . . . . [Reactive back side gas]
16/458 . . . . [characterised by the method used for supporting substrates in the reaction chamber]
16/4581 . . . . [characterised by material of construction or surface finish of the means for supporting the substrate]
16/4582 . . . . [Rigid and flat substrates, e.g. plates or discs (C23C 16/4581 takes precedence)]
16/4583 . . . . [the substrate being supported substantially horizontally]
16/4584 . . . . [the substrate being rotated]
16/4585 . . . . [Devices at or outside the perimeter of the substrate support, e.g. clamping rings, shrouds]
16/4586 . . . . {Elements in the interior of the support, e.g. electrodes, heating or cooling devices}
16/4587 . . . . [the substrate being supported substantially vertically]
16/4588 . . . . [the substrate being rotated]
16/46 . . . . [characterised by the method used for heating the substrate (C23C 16/48, C23C 16/50 take precedence)]
16/463 . . . . [Cooling of the substrate]
16/466 . . . . [using thermal contact gas]
16/48 . . . . by irradiation, e.g. photolysis, radiolysis, particle radiation
16/481 . . . . [by radiant heating of the substrate]
16/482 . . . . [using incoherent light, UV to IR, e.g. lamps]
16/483 . . . . [using coherent light, UV to IR, e.g. lasers]
16/484 . . . . [using X-ray radiation]
16/485 . . . . [using synchrotron radiation]
16/486 . . . . [using ion beam radiation]
16/487 . . . . [using electron radiation]
16/488 . . . . [Protection of windows for introduction of radiation into the coating chamber]
16/50 . . . . [using electric discharges (generation and control of plasma in discharge tubes for surface treatment H01J 37/32, H01J 37/34)]
16/503 . . . . [using dc or ac discharges]
16/505 . . . . [using radio frequency discharges]
16/507 . . . . [using external electrodes, e.g. in tunnel type reactors]
16/509 . . . . [using internal electrodes]
16/5093 . . . . [C coaxial electrodes]
16/5096 . . . . [Flat-bed apparatus]
16/511 . . . . [using microwave discharges]
16/513 . . . . [using plasma jets]
16/515 . . . . [using pulsed discharges]
16/517 . . . . [using a combination of discharges covered by two or more of groups C23C 16/503 - C23C 16/515]
16/52 . . . . [Controlling or regulating the coating process (C23C 16/45557, C23C 16/279 take precedence)]
16/54 . . . . [Apparatus specially adapted for continuous coating]
16/545 . . . . [for coating elongated substrates]
16/56 . . . . [After-treatment]
Chemical deposition or plating by decomposition; Contact plating

**NOTE**
This group covers also suspensions containing reactive liquids and non-reactive solid particles.

18/00 Chemical coating by decomposition of either liquid compounds or solutions of the coating forming compounds, without leaving reaction products of surface material in the coating; Contact plating

18/02 . . by thermal decomposition
18/04 . . Pretreatment of the material to be coated (C23C 18/06 takes precedence)
18/06 . . Coating on selected surface areas, e.g. using masks
18/08 . . Deposition characterised by the deposition of metallic material
18/10 . . . Deposition of aluminium only
18/12 . . . characterised by the deposition of inorganic material other than metallic material
18/1204 . . . [inorganic material, e.g. non-oxide and non-metal such as sulfides, nitrides based compounds]
18/1208 . . . [Oxides, e.g. ceramics]
18/1212 . . . . [Zeolites, glasses]
18/1216 . . . . . [Metal oxides (C23C 18/1212 takes precedence)]
18/122 . . . . [Inorganic polymers, e.g. silanes, polysilazanes, polysiloxanes]
18/1225 . . . [Deposition of multilayers of inorganic material]
18/1229 . . . [Composition of the substrate]
18/1233 . . . [Organic substrates]
18/1237 . . . . . [Composite substrates, e.g. laminated, premixed]
18/1241 . . . [Metallic substrates]
18/1245 . . . [Inorganic substrates other than metallic]
18/125 . . . . [Process of deposition of the inorganic material]
18/1254 . . . . [Sol or sol-gel processing]
18/1258 . . . . [Spray pyrolysis]
18/1262 . . . . . [involving particles, e.g. carbon nanotubes (CNT), flakes]
18/1266 . . . . . . [Particles formed in situ]
18/127 . . . . . . [Preformed particles]
18/1275 . . . . . . [performed under inert atmosphere]
18/1279 . . . . . . . [performed under reactive atmosphere, e.g. oxidising or reducing atmospheres]
18/1283 . . . . . . . [Control of temperature, e.g. gradual temperature increase, modulation of temperature]
18/1287 . . . . . . . . [with flow inducing means, e.g. ultrasonic]
18/1291 . . . . . . . [by heating of the substrate]
18/1295 . . . . . . . . [with after-treatment of the deposited inorganic material]
18/14 . . Decomposition by irradiation, e.g. photolysis, particle radiation [or by mixed irradiation sources]
18/143 . . . . [Radiation by light, e.g. photolysis or pyrolysis]
18/145 . . . [Radiation by charged particles, e.g. electron beams or ion irradiation]
18/16 . . by reduction or substitution, e.g. electroless plating (C23C 18/54 takes precedence)
18/1601 . . . [Process or apparatus]
18/1603 . . . [coating on selected surface areas]
18/1605 . . . . [by masking]
18/168 . . . . . . {Control of temperature, e.g. temperature of bath, substrate}
18/1682 . . . . . . {Control of atmosphere}
18/1683 . . . . . . {Control of electrolyte composition, e.g. measurement, adjustment (regeneration of bath C23C 18/1617)}
18/1685 . . . . . . {with supercritical condition, e.g. chemical fluid deposition}
18/1687 . . . . . . {with ionic liquid}
18/1689 . . . . . . {After-treatment}
18/1691 . . . . . . {Cooling, e.g. forced or controlled cooling}
18/1692 . . . . . . {Heat-treatment}
18/1694 . . . . . . {Sequential heat treatment}
18/1696 . . . . . . {Control of atmosphere}
18/1698 . . . . . . {Control of temperature}
18/18 . . . Pretreatment of the material to be coated
18/1803 . . . {of metallic material surfaces or of a non-specific material surfaces}
18/1806 . . . . . . {by mechanical pretreatment, e.g. grinding, sanding}
18/181 . . . . . . {by formation of electrostatic charges, e.g. tribofriction}
18/1813 . . . . . . {by radiant energy}
18/1817 . . . . . . {Heat}
18/182 . . . . . . {Radiation, e.g. UV, laser}
18/1824 . . . . . . {by chemical pretreatment}
18/1827 . . . . . . {only one step pretreatment}
18/1831 . . . . . . {Use of metal, e.g. activation, sensitisation with noble metals}
18/1834 . . . . . . {Use of organic or inorganic compounds other than metals, e.g. activation, sensitisation with polymers}
18/1837 . . . . . . {Multistep pretreatment}
18/1841 . . . . . . {with use of metal first}
18/1844 . . . . . . {with use of organic or inorganic compounds other than metals, first}
18/1848 . . . . . . {by electrochemical pretreatment}
18/1851 . . . . . . {of surfaces of non-metallic or semiconducting material}
18/1855 . . . . . . {by mechanical pretreatment, e.g. grinding, sanding}

**WARNING**

the groups C23C 18/22 - C23C 18/2013 are not complete, pending reorganisation. See also C23C 18/2006

18/1896 . . . . . . {by electrochemical pretreatment}
18/20 . . . . . . . . of organic surfaces, e.g. resins
18/2006 . . . . {by other methods than those of C23C 18/22 - C23C 18/30}
18/2013 . . . . . . {by mechanical pretreatment, e.g. grinding, sanding}

**WARNING**

the groups C23C 18/2013 - C23C 18/2093 are not complete, pending reorganisation. See also C23C 18/2006

18/202 . . . . . . . . {by formation of electrostatic charges, e.g. tribofriction}
18/2026 . . . . . . . . {by radiant energy}
18/2033 . . . . . . . . {Heat}
18/204 . . . . . . . . {Radiation, e.g. UV, laser}
18/2046 . . . . . . . . {by chemical pretreatment}
18/2053 . . . . . . . . {only one step pretreatment}
18/206 . . . . . . . . {Use of metal other than noble metals and tin, e.g. activation, sensitisation with metals (sensitising with tin C23C 18/285, sensitising with noble metals C23C 18/30)}
18/2066 . . . . . . . . {Use of organic or inorganic compounds other than metals, e.g. activation, sensitisation with polymers}
18/2073 . . . . . . . . {Multistep pretreatment}
18/208 . . . . . . . . {with use of metal first}
18/2086 . . . . . . . . {with use of organic or inorganic compounds other than metals, first}
18/2093 . . . . . . . . {by electrochemical pretreatment}
18/22 . . . . . . . . {Roughening, e.g. by etching}
18/24 . . . . . . . . {using acid aqueous solutions}
18/26 . . . . . . . . {using organic liquids}
18/28 . . . . . . . . {Sensitising or activating}
18/285 . . . . . . . . {Sensitising or activating with tin based compound or composition}
18/30 . . . . . . . . {Activating [or accelerating or sensitising with palladium or other noble metal]}
18/31 . . . . . . Coating with metals
18/32 . . . . . . Coating with nickel, cobalt or mixtures thereof with phosphorus or boron (C23C 18/50 takes precedence)
18/34 . . . . . . {using reducing agents}
18/36 . . . . . . {using hypophosphites}
18/38 . . . . . . {Coating with copper}
18/40 . . . . . . {using reducing agents}
18/405 . . . . . . {Formaldehyde}
18/42 . . . . . . {Coating with noble metals}
18/44 . . . . . . {using reducing agents}
18/48 . . . . . . {Coating with alloys}
18/50 . . . . . . {with alloys based on iron, cobalt or nickel}
18/52 . . . . . . {using reducing agents for coating with metallic material not provided for in a single one of groups C23C 18/32 - C23C 18/50}
18/54 . . . . . . Contact plating, i.e. electroless electrochemical plating
Chemical deposition or plating by decomposition; Contact plating

22/00  Chemical surface treatment of metallic material by reaction of the surface with a reactive medium (with a reactive gas C23C 8/00)

22/02  . . . Coating with metallic material
22/04  . . . with metals
22/06  . . . Coating with inorganic material, other than metallic material
22/08  . . . with compounds, mixtures or solid solutions, e.g. borides, carbides, nitrides

Chemical surface treatment of metallic material by reaction of the surface with a reactive medium by decomposition of either solid compounds or suspensions of the coating forming compounds, without leaving reaction products of surface material in the coating

NOTE
This group covers also suspensions containing non-reactive liquids and reactive solid particles.

22/20  Chemical coating by decomposition of either solid compounds or suspensions of the coating forming compounds, without leaving reaction products of surface material in the coating

NOTE
This group covers also suspensions containing non-reactive liquids and reactive solid particles.

22/23  Containing also phosphates
22/23  Containing also hexavalent chromium compounds
22/24  Containing also organic compounds
22/27  Condensed phosphates
22/27  Acids
22/28  Macromolecular compounds
22/29  Containing also trivalent chromium
22/32  Containing also pulverulent metals
22/33  Containing also phosphates
22/34  Containing fluorides or complex fluorides
22/36  Containing also phosphates
22/36  [containing titanium, zirconium or hafnium compounds]
22/36  [containing also zinc cations]
22/36  [containing also manganese cations]
22/36  [containing also zinc and nickel cations]
22/37  [containing hexavalent chromium compounds]
22/38  [containing also phosphates]
22/40  [containing molybdates, tungstates or vanadates]
22/42  [containing also phosphates]
22/43  [containing also hexavalent chromium compounds]
22/44  [containing also fluorides or complex fluorides]
22/46  [containing oxalates]
22/47  [containing also phosphates]
22/48  [not containing phosphates, hexavalent chromium compounds, fluorides or complex fluorides, molybdates, tungstates, vanadates or oxalates]
22/50  Treatment of iron or alloys based thereon
22/52  Treatment of copper or alloys based thereon
22/53  Treatment of zinc or alloys based thereon
22/54  Treatment of refractory metals or alloys based thereon
22/56  Treatment of aluminium or alloys based thereon
22/57  Treatment of magnesium or alloys based thereon
22/58  Treatment of other metallic material
22/60  [using alkaline aqueous solutions with pH greater than 8]
22/62  Treatment of iron or alloys based thereon
22/63  Treatment of copper or alloys based thereon
22/64  Treatment of refractory metals or alloys based thereon
22/66  Treatment of aluminium or alloys based thereon
22/67  [with solutions containing hexavalent chromium]
22/68  [using aqueous solutions with pH between 6 and 8]
22/70  Using melts
22/72  Treatment of iron or alloys based thereon
22/73  Characterised by the process
22/74  [for obtaining burnished conversion coatings]
22/76  [Applying the liquid by spraying]
22/77  [Controlling or regulating of the coating process]
22/78  [Pretreatment of the material to be coated]
22/80  [with solutions containing titanium or zirconium compounds]
22/82  After-treatment
22/83  Chemical after-treatment
22/84  Dyeing
22/86  Regeneration of coating baths

24/00  Coating starting from inorganic powder (spraying of the coating material in molten state C23C 4/00; solid state diffusion C23C 8/00 - C23C 12/00)
24/02  By application of pressure only
### Chemical surface treatment of metallic material by reaction of the surface with a reactive medium

**Coating with metallic material, i.e. metals**

- **C23C 28/00**
  - by application of heat or pressure and heat (C23C 24/04 takes precedence)
- **C28/02**
  - applying molten material to the substrate

#### Coating for obtaining at least two superposed coatings either by methods not provided for in a single one of groups C23C 20/00 - C23C 26/00 or by combinations of methods provided for in subclasses C23C and C25C or C25D

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>28/02</td>
<td>only coatings (only including layers) of metallic material</td>
</tr>
<tr>
<td>28/021</td>
<td>including at least one metal alloy layer</td>
</tr>
<tr>
<td>28/022</td>
<td>with at least one MCrAlX layer</td>
</tr>
<tr>
<td>28/023</td>
<td>only coatings of metal elements only</td>
</tr>
<tr>
<td>28/025</td>
<td>with at least one zinc-based layer</td>
</tr>
<tr>
<td>28/026</td>
<td>including at least one amorphous metallic material layer</td>
</tr>
</tbody>
</table>
| 28/027 | including at least one metal matrix material comprising a mixture of at least two metals or metal phases or metal matrix composites, e.g. metal matrix with embedded inorganic hard particles, CERMET, MMC. |}

#### Coating with metallic material characterised only by the composition of the metallic material, i.e. not characterised by the coating process (C23C 26/00, C23C 28/00 take precedence)

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/00</td>
<td>Coating with metallic material characterised only by the composition of the metallic material, including hardness, density, physical properties</td>
</tr>
<tr>
<td>30/005</td>
<td>on hard metal substrates</td>
</tr>
</tbody>
</table>

#### Aspects relating to chemical surface treatment of metallic material by reaction of the surface with a reactive medium

- **2222/00**
  - Use of solutions containing trivalent chromium but free of hexavalent chromium
- **2222/10**
  - Use of solutions containing silanes
- **2222/20**
  - Use of solutions containing solution containing silanes