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)

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

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)

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

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

characterised by the coating material

Metallic material

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

containing MCrAl or MCrAlY alloys, where M is nickel, cobalt or iron, with or without non-metal elements

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

Oxides, borides, carbides, nitrides or silicides; Mixtures thereof

Oxides

characterised by the method of spraying

NOTE

In this group, multi-aspect classification is applied, so that subject matter characterised by aspects covered by more than one of its subgroups should be classified in each of those subgroups.

Spraying molten metal

Detonation spraying

Flame spraying

Wire arc spraying

Plasma spraying

Spraying in vacuum or in an inert atmosphere

for coating elongate material

Wires; Tubes

After-treatment

Coating by casting molten material on the substrate

Solid state diffusion into metallic material surfaces

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)

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

Treatment of selected surface areas, e.g. using masks

using gases (C23C 8/36 takes precedence)

only one element being applied

Oxidising

using elemental oxygen or ozone

Oxidising of ferrous surfaces

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

Oxidising of ferrous surfaces

Carburising

of ferrous surfaces

Nitriding

of ferrous surfaces

Carbo-nitriding

of ferrous surfaces

Carbo-nitriding

of ferrous surfaces

Nitriding

of ferrous surfaces

Carbo-nitriding

of ferrous surfaces

Carbo-nitriding

of ferrous surfaces

Carbo-nitriding

of ferrous surfaces

Nitriding

of ferrous surfaces

Carbo-nitriding

of ferrous surfaces

Nitriding

of ferrous surfaces

Carbo-nitriding

of ferrous surfaces

Nitriding

of ferrous surfaces

Carbo-nitriding

of ferrous surfaces

Nitriding

of ferrous surfaces

Carbo-nitriding

of ferrous surfaces

Nitriding

of ferrous surfaces

Carbo-nitriding
Solid state diffusion into metallic material surfaces

Coating by vacuum evaporation, by sputtering or by ion implantation

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

14/005  { 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 }

14/0087  { by cathodic sputtering }
14/0088  { of the type ABOₓ with A representing alkali, alkaline earth metal or Pb and B representing a refractory or rare earth metal }
14/0094  { in transition mode }
14/0089  { in metallic mode }
14/002  { Pretreatment of the material to be coated (C23C 14/04 takes precedence) }
14/021  { Cleaning or etching treatments }
14/022  { by means of bombardment with energetic particles or radiation }
14/024  { Deposition of sublayers, e.g. to promote adhesion of the coating (C23C 14/027 takes precedence) }
14/025  { Metallic sublayers }
14/027  { Graded interfaces }
14/028  { Physical treatment to alter the texture of the substrate surface, e.g. grinding, polishing }
14/04  { Coating on selected surface areas, e.g. using masks }
14/042  { using masks }
14/044  { using masks to redistribute rather than totally prevent coating, e.g. producing thickness gradient }
14/046  { Coating cavities or hollow spaces, e.g. interior of tubes; Infiltration of porous substrates }
14/048  { using irradiation by energy or particles }
14/06  { characterised by the coating material ([C23C 14/0021], C23C 14/04 take precedence) }
14/0605 { Carbon }
14/0611 { Diamond }
14/0617  { AI, BV compounds, where A is Al, Ga, In or TI and B is N, P, As, Sb or Bi }
14/0623 { Sulfides, selenides or tellurides }
14/0629 { of zinc, cadmium or mercury }
14/0635 { Carbides }
14/0641 { Nitrides (C23C 14/0617 takes precedence) }
14/0647  { Boron nitride }
14/0652  { Silicon nitride }
14/0658  { Carbon nitride }
14/0664  { Carbonitriles }
14/067  { Borides }
14/0676  { Oxyhydrimates }
14/0682  { Silicides }
14/0688  { Cerments, e.g. mixtures of metal and one or more of carbides, nitrides, oxides or borides }
14/0694  { Halides }
14/08  { Oxides (C23C 14/10 takes precedence) }
14/0811 { of aluminium, magnesium or beryllium }
14/082  { of alkali earth metals }
14/083  { of refractory metals or yttrium }
14/085  { of iron group metals }
14/086  { of zinc, germanium, cadmium, indium, tin, thallium or bismuth }
14/087  { of copper or solid solutions thereof }
14/088  { of the type ABOₓ with A representing alkali, alkaline earth metal or Pb and B representing a refractory or rare earth metal }
14/10  { Glass or silica }
14/12  { Organic material }
14/14  { Metallic material, boron or silicon }
14/16  { on metallic substrates or on substrates of boron or silicon }
14/165  { by cathodic sputtering }
14/18  { on other inorganic substrates }
14/185  { by cathodic sputtering }
14/20  { on organic substrates }
Coating by vacuum evaporation, by sputtering or by ion implantation

... characterised by the process of coating
14/22 . . . . . . . . . . . . . . characterised by the process of coating
14/221 . . . . . . . . . . . . . . (Ion beam deposition (C23C 14/46, C23C 14/48
take precedence))
14/223 . . . . . . . . . . . . . . (specially adapted for coating particles)
14/225 . . . . . . . . . . . . . . (Oblique incidence of vapourised material on
substrate)
14/228 . . . . . . . . . . . . . . (in order to form films with columnar
structure)
14/228 . . . . . . . . . . . . . . (Gas flow assisted PVD deposition)
14/24 . . . . . . . . . . . . . . Vacuum evaporation
14/243 . . . . . . . . . . . . . . Crucibles for source material (C23C 14/28,
C23C 14/30 take precedence)
14/246 . . . . . . . . . . . . . . (Replenishment of source material)
14/26 . . . . . . . . . . . . . . by resistance or inductive heating of the source
14/28 . . . . . . . . . . . . . . by wave energy or particle radiation
(C23C 14/32 - C23C 14/48 take precedence)
14/30 . . . . . . . . . . . . . . by electron bombardment
14/32 . . . . . . . . . . . . . . by explosion; by evaporation and subsequent
ionisation of the vapours (. e.g. ion-plating)
(C23C 14/34 - C23C 14/48 take precedence)
14/325 . . . . . . . . . . . . . . (Electric arc evaporation)
14/34 . . . . . . . . . . . . . . Sputtering
14/3407 . . . . . . . . . . . . . . [Cathode assembly for sputtering apparatus,
e.g. Target]
14/3414 . . . . . . . . . . . . . . [Metallurgical or chemical aspects of target
preparation, e.g. casting, powder metallurgy]
14/3421 . . . . . . . . . . . . . . [using heated targets]
14/3428 . . . . . . . . . . . . . . [using liquid targets]
14/3435 . . . . . . . . . . . . . . [Applying energy to the substrate during
sputtering]
14/3442 . . . . . . . . . . . . . . [using an ion beam]
14/345 . . . . . . . . . . . . . . [using substrate bias]
14/3457 . . . . . . . . . . . . . . [using other particles than noble gas ions
(C23C 14/0036, C23C 14/46 take precedence)]
14/3464 . . . . . . . . . . . . . . [using more than one target (C23C 14/56
takes precedence)]
14/3471 . . . . . . . . . . . . . . [Introduction of auxiliary energy into the
plasma]
14/3478 . . . . . . . . . . . . . . [using electrons, e.g. triode sputtering]
14/3485 . . . . . . . . . . . . . . [using pulsed power to the target]
14/3492 . . . . . . . . . . . . . . [Variation of parameters during sputtering]
14/35 . . . . . . . . . . . . . . by application of a magnetic field, e.g.
magnetron sputtering ([C23C 14/3457 takes
precedence])
14/351 . . . . . . . . . . . . . . [using a magnetic field in close vicinity to
the substrate]
14/352 . . . . . . . . . . . . . . [using more than one target (C23C 14/56
takes precedence)]
14/354 . . . . . . . . . . . . . . [Introduction of auxiliary energy into the
plasma]
14/355 . . . . . . . . . . . . . . [using electrons, e.g. triode sputtering]
14/357 . . . . . . . . . . . . . . [Microwaves, e.g. electron cyclotron
resonance enhanced sputtering]
14/358 . . . . . . . . . . . . . . [Inductive energy]
14/46 . . . . . . . . . . . . . . by ion beam produced by an external ion
source
14/48 . . . . . . . . . . . . . . Ion implantation
14/50 . . . . . . . . . . . . . . Substrate holders
14/505 . . . . . . . . . . . . . . [for rotation of the substrates]
14/52 . . . . . . . . . . . . . . Means for observation of the coating process
14/54 . . . . . . . . . . . . . . Controlling or regulating the coating process
14/541 . . . . . . . . . . . . . . [Heating or cooling of the substrates]
14/542 . . . . . . . . . . . . . . [Controlling the film thickness or evaporation
rate]
14/543 . . . . . . . . . . . . . . [using measurement on the vapor source]
14/544 . . . . . . . . . . . . . . [using measurement in the gas phase]
14/545 . . . . . . . . . . . . . . [using measurement on deposited material]
14/546 . . . . . . . . . . . . . . [using crystal oscillators]
14/547 . . . . . . . . . . . . . . [using optical methods]
14/548 . . . . . . . . . . . . . . [Controlling the composition]
14/56 . . . . . . . . . . . . . . Apparatus specially adapted for continuous
coating; Arrangements for maintaining the
cover, e.g. vacuum locks
14/562 . . . . . . . . . . . . . . [for coating elongated substrates]
14/564 . . . . . . . . . . . . . . [Means for minimising impurities in the
coating chamber such as dust, moisture,
residual gases]
14/566 . . . . . . . . . . . . . . [using a load-lock chamber]
14/568 . . . . . . . . . . . . . . [Transferring the substrates through a series
of coating stations (C23C 14/562 takes
precedence)]
14/58 . . . . . . . . . . . . . . After-treatment
14/5806 . . . . . . . . . . . . . . [Thermal treatment]
14/5813 . . . . . . . . . . . . . . [using lasers]
14/582 . . . . . . . . . . . . . . [using electron bombardment]
14/5826 . . . . . . . . . . . . . . [Treatment with charged particles (C23C 14/582
takes precedence)]
14/5833 . . . . . . . . . . . . . . [Ion beam bombardment]
14/584 . . . . . . . . . . . . . . [Non-reactive treatment]
14/5846 . . . . . . . . . . . . . . [Reactive treatment]
14/5853 . . . . . . . . . . . . . . [Oxidation]
14/586 . . . . . . . . . . . . . . [Nitriding]
14/5866 . . . . . . . . . . . . . . [Treatment with sulfur, selenium or tellurium]
14/5873 . . . . . . . . . . . . . . [Removal of material]
14/588 . . . . . . . . . . . . . . [by mechanical treatment]
14/5886 . . . . . . . . . . . . . . [Mechanical treatment (involving removal of
material C23C 14/588)]
14/5893 . . . . . . . . . . . . . . [Mixing of deposited material]

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)
16/003 . . . . . . . . . . . . . . [Coating on a liquid substrate]
16/006 . . . . . . . . . . . . . . [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)
16/0209 . . . . . . . . . . . . . . [by heating]
16/0218 . . . . . . . . . . . . . . [in a reactive atmosphere (C23C 16/0227 takes
precedence)]
16/0227 . . . . . . . . . . . . . . [by cleaning or etching]
16/0236 . . . . . . . . . . . . . . [by etching with a reactive gas]
16/0245 . . . . . . . . . . . . . . [by etching with a plasma]
16/0254 . . . . . . . . . . . . . . [Physical treatment to alter the texture of the
surface, e.g. scratching or polishing]
16/0263 . . . . . . . . . . . . . . [Irradiation with laser or particle beam]
16/0272 . . . . . . . . . . . . . . [Deposition of sub-layers, e.g. to promote the
adhesion of the main coating]
16/0281 . . . . . . . . . . . . . . [of metallic sub-layers (C23C 16/029 takes
precedence)]
Chemical deposition or plating by decomposition; Contact plating

CPC - 2020.08

16/029 . . . [Graded interfaces]
16/04 . Coating on selected surface areas, e.g. using masks
16/042 . . . [using masks]
16/045 . . . [Coating cavities or hollow spaces, e.g. interior of tubes; Infiltration of porous substrates]
16/047 . . . [using irradiation by energy or particles]
16/06 . characterised by the deposition of metallic material
16/08 . from metal halides
16/10 . . . Deposition of chromium only
16/12 . . . Deposition of aluminium only
16/14 . . . Deposition of only one other metal element
16/16 . . . from metal carbonyl compounds
16/18 . . . from metallo-organic compounds
16/20 . . . Deposition of aluminium only
16/22 . . . characterised by the deposition of inorganic material, other than metallic material
16/24 . . . Deposition of silicon only
16/26 . . . Deposition of carbon only
16/27 . . . Diamond only
16/271 . . . [using hot filaments]
16/272 . . . [using DC, AC or RF discharges]
16/274 . . . [using microwave discharges]
16/275 . . . [using combustion torches]
16/276 . . . [using plasma jets]
16/277 . . . [using other elements in the gas phase besides carbon and hydrogen; using other elements besides carbon, hydrogen and oxygen in case of use of combustion torches; using other elements besides carbon, hydrogen and inert gas in case of use of plasma jets]
16/278 . . . [doping or introduction of a secondary phase in the diamond]
16/279 . . . [control of diamond crystallography]
16/28 . . . Deposition of only one other non-metal element
16/30 . . . Deposition of compounds, mixtures or solid solutions, e.g. borides, carbides, nitrates
16/301 . . . [All BV compounds, where A is Al, Ga, In or Ti and B is N, P, As, Sb or Bi]
16/303 . . . [Nitrates]
16/305 . . . [Sulfides, selenides, or tellurides]
16/306 . . . [All BVI compounds, where A is Zn, Cd or Hg and B is S, Se or Te]
16/308 . . . [Oxy-nitrates]
16/32 . . . Carbides
16/325 . . . [Silicon carbide]
16/34 . . . Nitrates [(C23C 16/303 takes precedence)]
16/342 . . . [Boron nitride]
16/345 . . . [Silicon nitride]
16/347 . . . [Carbon nitride]
16/36 . . . Carbonitrides
16/38 . . . Borides
16/40 . . . Oxides
16/401 . . . [containing silicon]
16/402 . . . [Silicon dioxide]
16/403 . . . [of aluminium, magnesium or beryllium]
16/404 . . . [of alkaline earth metals]
16/405 . . . [of refractory metals or yttrium]
16/406 . . . [of iron group metals]
16/407 . . . [of zinc, germanium, cadmium, indium, tin, thallium or bismuth]
16/408 . . . [of copper or solid solutions thereof]
16/409 . . . [of the type ABO, with A representing alkali, alkaline earth metal or lead and B representing a refractory metal, nickel, scandium or a lanthanide]
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]
Chemical deposition or plating by decomposition; Contact plating

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]
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 . . . [Moveable 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 . . . [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]
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
18/06 . . . Coating on selected surface areas, e.g. using masks
18/08 . . . 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-metallic 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]

WARNING
Group C23C 18/14 is impacted by reclassification into groups C23C 18/143 and C23C 18/145.

Groups C23C 18/14, C23C 18/143, and C23C 18/145 should be considered in order to perform a complete search.

18/143 . . . [Radiation by light, e.g. photolysis or pyrolysis]

WARNING
Group C23C 18/143 is incomplete pending reclassification of documents from group C23C 18/14.

Groups C23C 18/14 and C23C 18/143 should be considered in order to perform a complete search.

18/145 . . . [Radiation by charged particles, e.g. electron beams or ion irradiation]

WARNING
Group C23C 18/145 is incomplete pending reclassification of documents from group C23C 18/14.

Groups C23C 18/14 and C23C 18/145 should be considered in order to perform a complete search.

18/16 . . . by reduction or substitution, e.g. electroless plating

WARNING
Groups C23C 18/14 and C23C 18/143 should be considered in order to perform a complete search.

18/1601 . . . [Process of apparatus]
18/1603 . . . . . [coating on selected surface areas]
18/1605 . . . . . . [by masking]
18/1607 . . . . . . [by direct patterning]
18/1608 . . . . . . . . . [from pretreatment step, i.e. selective pretreatment]
18/161 . . . . . . . . . . . . [from plating step, e.g. inkjet]
18/1612 . . . . . . . . . . . . [through irradiation means]
18/1614 . . . . . . . . . . . . [plating on one side]
18/1616 . . . . . . . . . . . . [interior or inner surface]
18/1617 . . . . . . . . . . . . [Purification and regeneration of coating baths]
18/1619 . . . . . . . . . . . . [Apparatus for electroless plating]
18/1621 . . . . . . . . . . . . [Protection of inner surfaces of the apparatus]
18/1623 . . . . . . . . . . . . [through electrochemical processes]
18/1625 . . . . . . . . . . . . [through chemical processes]
18/1626 . . . . . . . . . . . . [through mechanical processes]
18/1628 . . . . . . . . . . . . [Specific elements or parts of the apparatus]
18/163 . . . . . . . . . . . . [Supporting devices for articles to be coated]
18/1632 . . . . . . . . . . . . [Features specific for the apparatus, e.g. layout of cells and of its equipment, multiple cells]
18/1633 . . . . . . . . . . . . [Process of electroless plating]
18/1635 . . . . . . . . . . . . [Composition of the substrate]
18/1637 . . . . . . . . . . . . [metallic substrate]
18/1639 . . . . . . . . . . . . [Substrates other than metallic, e.g. inorganic or organic or non-conductive]
18/1641 . . . . . . . . . . . . . [Organic substrates, e.g. resin, plastic]

CPC - 2020.08
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>18/1844</td>
<td>(porous substrates)</td>
</tr>
<tr>
<td>18/1846</td>
<td>Characteristics of the product obtained</td>
</tr>
<tr>
<td>18/1848</td>
<td>Porous product</td>
</tr>
<tr>
<td>18/185</td>
<td>Multilayered product (layered product B32B)</td>
</tr>
<tr>
<td>18/1851</td>
<td>{Two or more layers only obtained by electroless plating}</td>
</tr>
<tr>
<td>18/1853</td>
<td>{Two or more layers with at least one layer obtained by electroless plating and one layer obtained by electroplating}</td>
</tr>
<tr>
<td>18/1855</td>
<td>{Process features}</td>
</tr>
<tr>
<td>18/1857</td>
<td>{Electroless forming, i.e. substrate removed or destroyed at the end of the process}</td>
</tr>
<tr>
<td>18/1858</td>
<td>(with two steps starting with metal deposition followed by addition of reducing agent)</td>
</tr>
<tr>
<td>18/186</td>
<td>{with two steps starting with addition of reducing agent followed by metal deposition}</td>
</tr>
<tr>
<td>18/1862</td>
<td>{Use of incorporated material in the solution or dispersion, e.g. particles, whiskers, wires}</td>
</tr>
<tr>
<td>18/1864</td>
<td>{with additional means during the plating process}</td>
</tr>
<tr>
<td>18/1866</td>
<td>{Ultrasonics}</td>
</tr>
<tr>
<td>18/1867</td>
<td>{Radiant energy, e.g. laser}</td>
</tr>
<tr>
<td>18/1869</td>
<td>{Agitation, e.g. air introduction}</td>
</tr>
<tr>
<td>18/1871</td>
<td>Electric field</td>
</tr>
<tr>
<td>18/1873</td>
<td>Magnetic field</td>
</tr>
<tr>
<td>18/1875</td>
<td>Process conditions</td>
</tr>
<tr>
<td>18/1876</td>
<td>Heating of the solution</td>
</tr>
<tr>
<td>18/1878</td>
<td>Heating of the substrate</td>
</tr>
<tr>
<td>18/1878</td>
<td>{Control of temperature, e.g. temperature of bath, substrate}</td>
</tr>
<tr>
<td>18/1882</td>
<td>Control of atmosphere</td>
</tr>
<tr>
<td>18/1883</td>
<td>Control of electrolyte composition, e.g. measurement, adjustment (regeneration of bath C23C 18/1617)</td>
</tr>
<tr>
<td>18/1885</td>
<td>{with supercritical condition, e.g. chemical fluid deposition}</td>
</tr>
<tr>
<td>18/1887</td>
<td>{with ionic liquid}</td>
</tr>
<tr>
<td>18/1889</td>
<td>{After-treatment}</td>
</tr>
<tr>
<td>18/1891</td>
<td>{Cooling, e.g. forced or controlled cooling}</td>
</tr>
<tr>
<td>18/1892</td>
<td>{Heat-treatment}</td>
</tr>
<tr>
<td>18/1894</td>
<td>{Sequential heat treatment}</td>
</tr>
<tr>
<td>18/1896</td>
<td>Control of atmosphere</td>
</tr>
<tr>
<td>18/1898</td>
<td>Control of temperature</td>
</tr>
<tr>
<td>18/18803</td>
<td>Pretreatment of the material to be coated</td>
</tr>
<tr>
<td>18/1806</td>
<td>{of metallic material surfaces or of a non-specific material surfaces}</td>
</tr>
<tr>
<td>18/181</td>
<td>{by mechanical pretreatment, e.g. grinding, sanding}</td>
</tr>
<tr>
<td>18/1813</td>
<td>{by formation of electrostatic charges, e.g. tribofriction}</td>
</tr>
<tr>
<td>18/1817</td>
<td>{Heat}</td>
</tr>
<tr>
<td>18/182</td>
<td>{Radiation, e.g. UV, laser}</td>
</tr>
<tr>
<td>18/1824</td>
<td>{by chemical pretreatment}</td>
</tr>
<tr>
<td>18/1827</td>
<td>{only one step pretreatment}</td>
</tr>
<tr>
<td>18/1831</td>
<td>{Use of metal, e.g. activation, sensitisation with noble metals}</td>
</tr>
<tr>
<td>18/1834</td>
<td>{Use of organic or inorganic compounds other than metals, e.g. activation, sensitisation with polymers}</td>
</tr>
<tr>
<td>18/1837</td>
<td>{Multistep pretreatment}</td>
</tr>
<tr>
<td>18/1841</td>
<td>{with use of metal first}</td>
</tr>
<tr>
<td>18/1844</td>
<td>{with use of organic or inorganic compounds other than metals, first}</td>
</tr>
<tr>
<td>18/1848</td>
<td>{by electrochemical pretreatment}</td>
</tr>
<tr>
<td>18/1851</td>
<td>{of surfaces of non-metallic or semiconducting in organic material}</td>
</tr>
<tr>
<td>18/1855</td>
<td>{by mechanical pretreatment, e.g. grinding, sanding}</td>
</tr>
</tbody>
</table>

**WARNING**

the groups C23C 18/1855 - C23C 18/1896 are not complete, pending reorganisation. See also C23C 18/18

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>18/1858</td>
<td>{by formation of electrostatic charges, e.g. tribofriction}</td>
</tr>
<tr>
<td>18/1862</td>
<td>{by radiant energy}</td>
</tr>
<tr>
<td>18/1865</td>
<td>{Heat}</td>
</tr>
<tr>
<td>18/1868</td>
<td>{Radiation, e.g. UV, laser}</td>
</tr>
<tr>
<td>18/1872</td>
<td>{by chemical pretreatment}</td>
</tr>
<tr>
<td>18/1875</td>
<td>{only one step pretreatment}</td>
</tr>
<tr>
<td>18/1879</td>
<td>{Use of metal, e.g. activation, sensitisation with noble metals}</td>
</tr>
<tr>
<td>18/1882</td>
<td>{Use of organic or inorganic compounds other than metals, e.g. activation, sensitisation with polymers}</td>
</tr>
<tr>
<td>18/1886</td>
<td>{Multistep pretreatment}</td>
</tr>
<tr>
<td>18/1889</td>
<td>{with use of metal first}</td>
</tr>
<tr>
<td>18/1893</td>
<td>{with use of organic or inorganic compounds other than metals, first}</td>
</tr>
<tr>
<td>18/1896</td>
<td>{by electrochemical pretreatment}</td>
</tr>
<tr>
<td>18/20</td>
<td>of organic surfaces, e.g. resins</td>
</tr>
<tr>
<td>18/2006</td>
<td>{by other methods than those of C23C 18/72 - C23C 18/38}</td>
</tr>
<tr>
<td>18/2013</td>
<td>{by mechanical pretreatment, e.g. grinding, sanding}</td>
</tr>
</tbody>
</table>

**WARNING**

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>18/202</td>
<td>{by formation of electrostatic charges, e.g. tribofriction}</td>
</tr>
<tr>
<td>18/2026</td>
<td>{by radiant energy}</td>
</tr>
<tr>
<td>18/2033</td>
<td>{Heat}</td>
</tr>
<tr>
<td>18/204</td>
<td>{Radiation, e.g. UV, laser}</td>
</tr>
<tr>
<td>18/2046</td>
<td>{by chemical pretreatment}</td>
</tr>
<tr>
<td>18/2053</td>
<td>{only one step pretreatment}</td>
</tr>
<tr>
<td>18/206</td>
<td>{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 18/38)}</td>
</tr>
<tr>
<td>18/2066</td>
<td>{Use of organic or inorganic compounds other than metals, e.g. activation, sensitisation with polymers}</td>
</tr>
</tbody>
</table>
Chemical deposition or plating by decomposition; Contact plating

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

Chemical surface treatment of metallic material by reaction of the surface with a reactive liquid, leaving reaction products of surface material in the coating, e.g. conversion coatings, passivation of metals

**NOTES**

1. This group covers also suspensions containing reactive liquids and non-reactive solid particles.
2. In groups C23C 22/02 - C23C 22/86, in the absence of an indication to the contrary, classification is made in the last appropriate place.

3. Rejuvenating of the bath is classified in the appropriate place for the specific bath composition.

In groups C23C 22/02 - C23C 22/86, in the absence of an indication to the contrary, classification is made in the last appropriate place.
Chemical surface treatment of metallic material by reaction of the surface with a reactive medium

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 burned-in 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
24/04 . . . . Impact or kinetic deposition of particles
24/045 . . . . {by trembling using impacting inert media}
24/06 . . . . Compressing powdered coating material, e.g. by milling
24/08 . . . . by application of heat or pressure and heat
(C23C 24/04 takes precedence)
24/082 . . . . {without intermediate formation of a liquid in the layer}
24/085 . . . . {Coating with metallic material, i.e. metals or metal alloys, optionally comprising hard particles, e.g. oxides, carbides or nitrides}
24/087 . . . . {Coating with metal alloys or metal elements only}
24/10 . . . . with intermediate formation of a liquid phase in the layer
24/103 . . . . {Coating with metallic material, i.e. metals or metal alloys, optionally comprising hard particles, e.g. oxides, carbides or nitrides}
24/106 . . . . {Coating with metal alloys or metal elements only}

26/00 Coating not provided for in groups C23C 2/00 - C23C 24/00
26/02 . . . . applying molten material to the substrate

28/00 Coating for obtaining at least two superposed coatings either by methods not provided for in a single one of groups C23C 2/00 - C23C 26/00 or by combinations of methods provided for in subclasses C23C and C25C or C25D

28/02 . . . . only coatings [only including layers] of metallic material
28/021 . . . . (including at least one metal alloy layer)
28/022 . . . . {with at least one MCrAlX layer}
28/023 . . . . {only coatings of metal elements only}
28/025 . . . . {with at least one zinc-based layer}
28/026 . . . . {including at least one amorphous metallic material layer}
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.}
28/028 . . . . {Including graded layers in composition or in physical properties, e.g. density, porosity, grain size}
28/04 . . . . only coatings of inorganic non-metallic material
28/042 . . . . {including a refractory ceramic layer, e.g. refractory metal oxides, ZrO₂, rare earth oxides}
28/044 . . . . {coatings specially adapted for cutting tools or wear applications}
28/046 . . . . {with at least one amorphous inorganic material layer, e.g. DLC, a-C:H, a-C:Me, the layer being doped or not}
28/048 . . . . {with layers graded in composition or physical properties}
28/30 . . . . {Coatings combining at least one metallic layer and at least one inorganic non-metallic layer}
28/32 . . . . {including at least one pure metallic layer}
28/321 . . . . {with at least one metal alloy layer}
28/3215 . . . . {at least one MCrAlX layer}
28/322 . . . . {only coatings of metal elements only}
28/3225 . . . . {with at least one zinc-based layer}
28/323 . . . . {with at least one amorphous metallic material layer}
28/324 . . . . {with at least one metal matrix material layer comprising a mixture of at least two metals or metal phases or a metal-matrix material with hard embedded particles, e.g. WC-Me}
28/325 . . . . {with layers graded in composition or in physical properties}
28/34 . . . . {including at least one inorganic non-metallic material layer, e.g. metal carbide, nitride, boride, silicide layer and their mixtures, enamels, phosphates and sulphates}
28/341 . . . . {with at least one carbide layer}
28/343 . . . . {with at least one DLC or an amorphous carbon based layer, the layer being doped or not}
28/345 . . . . {with at least one oxide layer}
28/3455 . . . . {with a refractory ceramic layer, e.g. refractory metal oxide, ZrO₂, rare earth oxides or a thermal barrier system comprising at least one refractory oxide layer}
28/347 . . . . {with layers adapted for cutting tools or wear applications}
28/36 . . . . {including layers graded in composition or physical properties}
28/40 . . . . {Coatings including alternating layers following a pattern, a periodic or defined repetition}
28/42 . . . . {characterized by the composition of the alternating layers}
Chemical surface treatment of metallic material by reaction of the surface with a reactive medium

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>28/44</td>
<td>Coating with metallic material characterized only by the composition of the metallic material, i.e. not characterized by the coating process (C23C 26/00, C23C 28/00 take precedence)</td>
</tr>
<tr>
<td>30/005</td>
<td>Coating with metallic material characterized only by a measurable physical property of the alternating layer or system, e.g. thickness, density, hardness</td>
</tr>
</tbody>
</table>

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

- Use of solutions containing trivalent chromium but free of hexavalent chromium
- Use of solutions containing silanes