SECTION C — CHEMISTRY; 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

Note(s) [4]

1. In this class, the following expression is used with the meaning indicated:
   - "metallic material" covers:
     a. metals;
     b. alloys.
2. Attention is drawn to the Note following the title of subclass C22C.

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) **[4]**

Note(s) [4]

In this subclass, an operation is considered as pretreatment 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 pretreatment or after-treatment and is classified as a multi-coating process.

Subclass index

Coating by applying the coating material in the molten state [4]

2/00 Hot-dipping or immersion processes for applying the coating material in the molten state without affecting the shape; Apparatus therefor [4, 2006.01]

2/02 • Pretreatment of the material to be coated, e.g. for coating on selected surface areas (C23C 2/30 takes precedence) **[4, 2006.01]**

2/04 • characterised by the coating material **[4, 2006.01]**

2/06 • • Zinc or cadmium or alloys based thereon **[4, 2006.01]**

2/08 • • Tin or alloys based thereon **[4, 2006.01]**

2/10 • • Lead or alloys based thereon **[4, 2006.01]**

2/12 • • Aluminium or alloys based thereon **[4, 2006.01]**

2/14 • Removing excess of molten coatings; Controlling or regulating the coating thickness **[4, 2006.01]**

2/16 • • using fluids under pressure, e.g. air knives **[4, 2006.01]**

2/18 • • • Removing excess of molten coatings from elongated material **[4, 2006.01]**

2/20 • • • • Strips; Plates **[4, 2006.01]**

2/22 • • by rubbing, e.g. using knives **[4, 2006.01]**

2/24 • • using magnetic or electric fields **[4, 2006.01]**

2/26 • After-treatment (C23C 2/14 takes precedence) **[4, 2006.01]**

2/28 • • Thermal after-treatment, e.g. treatment in oil bath **[4, 2006.01]**

2/30 • Fluxes or coverings on molten baths (C23C 2/22 takes precedence) **[4, 2006.01]**
2/32 • using vibratory energy applied to the bath or substrate (C23C 2/14 takes precedence) **[4, 2006.01]**
2/34 • characterised by the shape of the material to be treated (C23C 2/14 takes precedence) **[4, 2006.01]**
2/36 • • Elongated material **[4, 2006.01]**
2/38 • • • Wires; Tubes **[4, 2006.01]**
2/40 • • • Plates; Strips **[4, 2006.01]**

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, 2006.01, 2016.01]**
4/01 • Selective coating, e.g. pattern coating, without pre-treatment of the material to be coated **[2016.01]**
4/02 • Pretreatment of the material to be coated, e.g. for coating on selected surface areas **[4, 2006.01]**
4/04 • characterised by the coating material **[4, 2006.01]**
4/06 • • Metallic material **[4, 2006.01, 2016.01]**
4/067 • • • containing free particles of non-metal elements, e.g. carbon, silicon, boron, phosphorus or arsenic **[2016.01]**
4/073 • • • containing MCrAl or MCrAlY alloys, where M is nickel, cobalt or iron, with or without non-metal elements **[2016.01]**
4/08 • • • containing only metal elements (C23C 4/073 takes precedence) **[4, 2006.01, 2016.01]**
4/10 • • Oxides, borides, carbides, nitrides or silicides; Mixtures thereof **[4, 2006.01, 2016.01]**
4/11 • • • Oxides **[2016.01]**
4/12 • characterised by the method of spraying **[4, 2006.01, 2016.01]**
4/123 • • Spraying molten metal **[2016.01]**
4/126 • • Detonation spraying **[2016.01]**
4/129 • • Flame spraying **[2016.01]**
4/131 • • Wire arc spraying **[2016.01]**
4/134 • • Plasma spraying **[2016.01]**
4/137 • • Spraying in vacuum or in an inert atmosphere **[2016.01]**
4/14 • • for coating elongate material **[4, 2006.01, 2016.01]**
4/16 • • • Wires; Tubes **[4, 2006.01, 2016.01]**
4/18 • After-treatment **[4, 2006.01]**

6/00 Coating by casting molten material on the substrate [4, 2006.01]

Solid state diffusion into metallic material surfaces [4]

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) **[4, 2006.01]**
8/02 • Pretreatment of the material to be coated (C23C 8/04 takes precedence) **[4, 2006.01]**
8/04 • Treatment of selected surface areas, e.g. using masks **[4, 2006.01]**
8/06 • using gases **[4, 2006.01]**
8/08 • • only one element being applied **[4, 2006.01]**
8/10 • • • Oxidising **[4, 2006.01]**
8/12 • • • • using elemental oxygen or ozone **[4, 2006.01]**
8/14 • • • • • Oxidising of ferrous surfaces **[4, 2006.01]**
8/16 • • • using oxygen-containing compounds, e.g. H_2O, CO_2 **[4, 2006.01]**
8/18 • • • • • Oxidising of ferrous surfaces **[4, 2006.01]**
8/20 • • • Carburising **[4, 2006.01]**
8/22 • • • • of ferrous surfaces **[4, 2006.01]**
8/24 • • • Nitriding **[4, 2006.01]**
8/26 • • • • of ferrous surfaces **[4, 2006.01]**
8/28 • • more than one element being applied in one step **[4, 2006.01]**
8/30 • • • Carbo-nitriding **[4, 2006.01]**
8/32 • • • • of ferrous surfaces **[4, 2006.01]**
8/34 • • more than one element being applied in more than one step **[4, 2006.01]**
8/36 • • using ionised gases, e.g. ionitriding **[4, 2006.01]**
8/38 • • • Treatment of ferrous surfaces **[4, 2006.01]**
8/40 • using liquids, e.g. salt baths, liquid suspensions **[4, 2006.01]**
8/42 • • only one element being applied **[4, 2006.01]**
8/44 • • • Carburising **[4, 2006.01]**
8/46 • • • • of ferrous surfaces **[4, 2006.01]**
8/48 • • • Nitriding **[4, 2006.01]**
8/50 • • • • of ferrous surfaces **[4, 2006.01]**
8/52 • • more than one element being applied in one step **[4, 2006.01]**
8/54 • • • Carbo-nitriding **[4, 2006.01]**
8/56 • • • • of ferrous surfaces **[4, 2006.01]**
8/58 • • more than one element being applied in more than one step **[4, 2006.01]**
8/60 • using solids, e.g. powders, pastes (using liquid suspensions of solids C23C 8/40) **[4, 2006.01]**
8/62 • • only one element being applied **[4, 2006.01]**
8/64 • • • Carburising **[4, 2006.01]**
8/66 • • • • of ferrous surfaces **[4, 2006.01]**
8/68 • • • Boronising **[4, 2006.01]**
8/70 • • • • of ferrous surfaces **[4, 2006.01]**
8/72 • • more than one element being applied in one step **[4, 2006.01]**
8/74 • • • Carbo-nitriding **[4, 2006.01]**
8/76 • • • • of ferrous surfaces **[4, 2006.01]**
8/78 • • more than one element being applied in more than one step **[4, 2006.01]**
8/80 • After-treatment **[4, 2006.01]**

10/00 Solid state diffusion of only metal elements or silicon into metallic material surfaces [4, 2006.01]
10/02 • Pretreatment of the material to be coated (C23C 10/04 takes precedence) **[4, 2006.01]**
10/04 • Diffusion into selected surface areas, e.g. using masks **[4, 2006.01]**
10/06 • using gases **[4, 2006.01]**
10/08 • • only one element being diffused **[4, 2006.01]**
10/10 • • • Chromising **[4, 2006.01]**
10/12 • • • • of ferrous surfaces **[4, 2006.01]**
10/14 • • more than one element being diffused in one step **[4, 2006.01]**
10/16 • • more than one element being diffused in more than one step **[4, 2006.01]**
10/18 • using liquids, e.g. salt baths, liquid suspensions **[4, 2006.01]**
10/20 • • only one element being diffused **[4, 2006.01]**
10/22 • • • Metal melt containing the element to be diffused **[4, 2006.01]**

10/24 • • • Salt bath containing the element to be diffused **[4, 2006.01]**
10/26 • • more than one element being diffused **[4, 2006.01]**
10/28 • using solids, e.g. powders, pastes **[4, 2006.01]**
10/30 • • using a layer of powder or paste on the surface (using liquid suspensions of solids C23C 10/18) **[4, 2006.01]**
10/32 • • • Chromising **[4, 2006.01]**
10/34 • • Embedding in a powder mixture, i.e. pack cementation **[4, 2006.01]**
10/36 • • • only one element being diffused **[4, 2006.01]**
10/38 • • • • Chromising **[4, 2006.01]**
10/40 • • • • • of ferrous surfaces **[4, 2006.01]**
10/42 • • • • • • in the presence of volatile transport additives, e.g. halogenated substances **[4, 2006.01]**
10/44 • • • • Siliconising **[4, 2006.01]**
10/46 • • • • • of ferrous surfaces **[4, 2006.01]**
10/48 • • • • Aluminising **[4, 2006.01]**
10/50 • • • • • of ferrous surfaces **[4, 2006.01]**
10/52 • • • more than one element being diffused in one step **[4, 2006.01]**
10/54 • • • • Diffusion of at least chromium **[4, 2006.01]**
10/56 • • • • • and at least aluminium **[4, 2006.01]**
10/58 • • • more than one element being diffused in more than one step **[4, 2006.01]**
10/60 • After-treatment **[4, 2006.01]**

12/00 Solid state diffusion of at least one non-metal element other than silicon and at least one metal element or silicon into metallic material surfaces [4, 2006.01]
12/02 • Diffusion in one step **[4, 2006.01]**

Coating by vacuum evaporation, by sputtering or by ion implantation [4]

14/00 Coating by vacuum evaporation, by sputtering or by ion implantation of the coating forming material [4, 2006.01]

14/02 • Pretreatment of the material to be coated (C23C 14/04 takes precedence) **[4, 2006.01]**
14/04 • Coating on selected surface areas, e.g. using masks **[4, 2006.01]**
14/06 • characterised by the coating material (C23C 14/04 takes precedence) **[4, 2006.01]**
14/08 • • Oxides (C23C 14/10 takes precedence) **[4, 2006.01]**
14/10 • • Glass or silica **[4, 2006.01]**
14/12 • • Organic material **[4, 2006.01]**
14/14 • • Metallic material, boron or silicon **[4, 2006.01]**
14/16 • • • on metallic substrates or on substrates of boron or silicon **[4, 2006.01]**
14/18 • • • on other inorganic substrates **[4, 2006.01]**
14/20 • • • on organic substrates **[4, 2006.01]**
14/22 • characterised by the process of coating **[4, 2006.01]**
14/24 • • Vacuum evaporation **[4, 2006.01]**
14/26 • • • by resistance or inductive heating of the source **[4, 2006.01]**
14/28 • • • by wave energy or particle radiation (C23C 14/32-C23C 14/48 take precedence) **[4, 2006.01]**
14/30 • • • • by electron bombardment **[4, 2006.01]**
14/32 • • • by explosion; by evaporation and subsequent ionisation of the vapours (C23C 14/34-C23C 14/48 take precedence) **[4, 2006.01]**
14/34 • • Sputtering **[4, 2006.01]**
14/35 • • • by application of a magnetic field, e.g. magnetron sputtering **[5, 2006.01]**
14/36 • • • Diode sputtering (C23C 14/35 takes precedence) **[4, 5, 2006.01]**
14/38 • • • • by direct current glow discharge **[4, 2006.01]**
14/40 • • • • with alternating current discharge, e.g. high-frequency discharge **[4, 2006.01]**
14/42 • • • Triode sputtering (C23C 14/35 takes precedence) **[4, 5, 2006.01]**
14/44 • • • • by application of high frequencies and additional direct voltages **[4, 2006.01]**
14/46 • • • by ion beam produced by an external ion source (C23C 14/40 takes precedence) **[4, 2006.01]**
14/48 • • Ion implantation **[4, 2006.01]**
14/50 • • Substrate holders **[4, 2006.01]**
14/52 • • Means for observation of the coating process **[4, 2006.01]**
14/54 • • Controlling or regulating the coating process **[4, 2006.01]**
14/56 • • Apparatus specially adapted for continuous coating; Arrangements for maintaining the vacuum, e.g. vacuum locks **[4, 2006.01]**
14/58 • After-treatment **[4, 2006.01]**

Chemical deposition or plating by decomposition; Contact plating [4]

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) **[4, 2006.01]**
16/01 • on temporary substrates, e.g. on substrates subsequently removed by etching **[7, 2006.01]**
16/02 • Pretreatment of the material to be coated (C23C 16/04 takes precedence) **[4, 2006.01]**
16/04 • Coating on selected surface areas, e.g. using masks **[4, 2006.01]**
16/06 • characterised by the deposition of metallic material **[4, 2006.01]**
16/08 • • from metal halides **[4, 2006.01]**
16/10 • • • Deposition of chromium only **[4, 2006.01]**
16/12 • • • Deposition of aluminium only **[4, 2006.01]**
16/14 • • • Deposition of only one other metal element **[4, 2006.01]**
16/16 • • from metal carbonyl compounds **[4, 2006.01]**
16/18 • • from metallo-organic compounds **[4, 2006.01]**
16/20 • • • Deposition of aluminium only **[4, 2006.01]**
16/22 • characterised by the deposition of inorganic material, other than metallic material **[4, 2006.01]**
16/24 • • Deposition of silicon only **[4, 2006.01]**
16/26 • • Deposition of carbon only **[4, 2006.01]**
16/27 • • • Diamond only **[7, 2006.01]**
16/28 • • Deposition of only one other non-metal element **[4, 2006.01]**
16/30 • • Deposition of compounds, mixtures or solid solutions, e.g. borides, carbides, nitrides **[4, 2006.01]**
16/32 • • • Carbides **[4, 2006.01]**
16/34 • • • Nitrides **[4, 2006.01]**
16/36 • • • Carbo-nitrides **[4, 2006.01]**

16/38 • • • Borides **[4, 2006.01]**
16/40 • • • Oxides **[4, 2006.01]**
16/42 • • • Silicides **[4, 2006.01]**
16/44 • characterised by the method of coating (C23C 16/04 takes precedence) **[4, 2006.01]**
16/442 • • using fluidised bed processes **[7, 2006.01]**
16/448 • • characterised by the method used for generating reactive gas streams, e.g. by evaporation or sublimation of precursor materials **[7, 2006.01]**
16/452 • • • by activating reactive gas streams before introduction into the reaction chamber, e.g. by ionization or by addition of reactive species **[7, 2006.01]**
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) **[7, 2006.01]**
16/455 • • characterised by the method used for introducing gases into the reaction chamber or for modifying gas flows in the reaction chamber **[7, 2006.01]**
16/458 • • characterised by the method used for supporting substrates in the reaction chamber **[7, 2006.01]**
16/46 • • characterised by the method used for heating the substrate (C23C 16/48, C23C 16/50 take precedence) **[4, 2006.01]**
16/48 • • by irradiation, e.g. photolysis, radiolysis, particle radiation **[4, 2006.01]**
16/50 • • using electric discharges **[4, 2006.01]**
16/503 • • • using dc or ac discharges **[7, 2006.01]**
16/505 • • • using radio frequency discharges **[7, 2006.01]**
16/507 • • • • using external electrodes, e.g. in tunnel type reactors **[7, 2006.01]**
16/509 • • • • using internal electrodes **[7, 2006.01]**
16/511 • • • using microwave discharges **[7, 2006.01]**
16/513 • • • using plasma jets **[7, 2006.01]**
16/515 • • • using pulsed discharges **[7, 2006.01]**
16/517 • • • using a combination of discharges covered by two or more of groups C23C 16/503-C23C 16/515 **[7, 2006.01]**
16/52 • • Controlling or regulating the coating process **[4, 2006.01]**
16/54 • • Apparatus specially adapted for continuous coating **[4, 2006.01]**
16/56 • After-treatment **[4, 2006.01]**

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 [4, 2006.01]

Note(s) [4]

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

18/02 • by thermal decomposition **[4, 2006.01]**
18/04 • • Pretreatment of the material to be coated (C23C 18/06 takes precedence) **[4, 2006.01]**
18/06 • • Coating on selected surface areas, e.g. using masks **[4, 2006.01]**
18/08 • • characterised by the deposition of metallic material **[4, 2006.01]**
18/10 • • • Deposition of aluminium only **[4, 2006.01]**
18/12 • • characterised by the deposition of inorganic material other than metallic material **[4, 2006.01]**
18/14 • Decomposition by irradiation, e.g. photolysis, particle radiation **[4, 2006.01]**
18/16 • by reduction or substitution, i.e. electroless plating (C23C 18/54 takes precedence) **[4, 2006.01]**
18/18 • • Pretreatment of the material to be coated **[4, 2006.01]**
18/20 • • • of organic surfaces, e.g. resins **[4, 2006.01]**
18/22 • • • • Roughening, e.g. by etching **[4, 2006.01]**
18/24 • • • • • using acid aqueous solutions **[4, 2006.01]**
18/26 • • • • • using organic liquids **[4, 2006.01]**
18/28 • • • • Sensitising or activating **[4, 2006.01]**
18/30 • • • • • Activating **[4, 2006.01]**
18/31 • • Coating with metals **[5, 2006.01]**
18/32 • • • Coating with one of iron, cobalt or nickel; Coating with mixtures of phosphorus or boron with one of these metals **[4, 5, 2006.01]**
18/34 • • • • using reducing agents **[4, 5, 2006.01]**
18/36 • • • • • using hypophosphites **[4, 5, 2006.01]**
18/38 • • • Coating with copper **[4, 5, 2006.01]**
18/40 • • • • using reducing agents **[4, 5, 2006.01]**
18/42 • • • Coating with noble metals **[4, 5, 2006.01]**
18/44 • • • • using reducing agents **[4, 5, 2006.01]**
18/48 • • Coating with alloys **[4, 5, 2006.01]**
18/50 • • • with alloys based on iron, cobalt or nickel (C23C 18/32 takes precedence) **[4, 5, 2006.01]**
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 **[4, 2006.01]**
18/54 • Contact plating, i.e. electroless electrochemical plating **[4, 2006.01]**

20/00 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 [4, 2006.01]

Note(s) [4]

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

20/02 • Coating with metallic material **[4, 2006.01]**
20/04 • • with metals **[4, 2006.01]**
20/06 • Coating with inorganic material, other than metallic material **[4, 2006.01]**
20/08 • • with compounds, mixtures or solid solutions, e.g. borides, carbides, nitrides **[4, 2006.01]**

22/00 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 [4, 2006.01]

Note(s) [4]

1. This group covers also suspensions containing reactive liquids and non-reactive solid particles.
2. Rejuvenating of the bath is classified in the appropriate place for the specific bath composition.

Note(s) [4]

In groups C23C 22/02-C23C 22/86, the last place priority rule is applied, i.e. at each hierarchical level, in the absence of an indication to the contrary, classification is made in the last appropriate place.

22/02 • using non-aqueous solutions **[4, 2006.01]**
22/03 • • containing phosphorus compounds **[4, 2006.01]**

22/04 • • containing hexavalent chromium compounds **[4, 2006.01]**
22/05 • using aqueous solutions **[5, 2006.01]**
22/06 • • using aqueous acidic solutions with pH < 6 **[4, 5, 2006.01]**
22/07 • • • containing phosphates **[4, 5, 2006.01]**
22/08 • • • • Orthophosphates **[4, 5, 2006.01]**
22/10 • • • • • containing oxidants **[4, 5, 2006.01]**
22/12 • • • • • containing zinc cations **[4, 5, 2006.01]**
22/13 • • • • • • containing also nitrate or nitrite anions **[4, 5, 2006.01]**
22/14 • • • • • • containing also chlorate anions **[4, 5, 2006.01]**
22/16 • • • • • • containing also peroxy-compounds **[4, 5, 2006.01]**
22/17 • • • • • • containing also organic acids **[4, 5, 2006.01]**
22/18 • • • • • containing manganese cations **[4, 5, 2006.01]**
22/20 • • • • • containing aluminium cations **[4, 5, 2006.01]**
22/22 • • • • • containing alkaline earth metal cations **[4, 5, 2006.01]**
22/23 • • • • Condensed phosphates **[4, 5, 2006.01]**
22/24 • • • containing hexavalent chromium compounds **[4, 5, 2006.01]**
22/26 • • • • containing also organic compounds **[4, 5, 2006.01]**
22/27 • • • • • Acids **[4, 5, 2006.01]**
22/28 • • • • • Macromolecular compounds **[4, 5, 2006.01]**
22/30 • • • • containing also trivalent chromium **[4, 5, 2006.01]**
22/32 • • • • containing also pulverulent metals **[4, 5, 2006.01]**
22/33 • • • • containing also phosphates **[4, 5, 2006.01]**
22/34 • • • containing fluorides or complex fluorides **[4, 5, 2006.01]**
22/36 • • • • containing also phosphates **[4, 5, 2006.01]**
22/37 • • • • containing also hexavalent chromium compounds **[4, 5, 2006.01]**
22/38 • • • • • containing also phosphates **[4, 5, 2006.01]**
22/40 • • • containing molybdates, tungstates or vanadates **[4, 5, 2006.01]**
22/42 • • • • containing also phosphates **[4, 5, 2006.01]**
22/43 • • • • containing also hexavalent chromium compounds **[4, 5, 2006.01]**
22/44 • • • • containing also fluorides or complex fluorides **[4, 5, 2006.01]**
22/46 • • • containing oxalates **[4, 5, 2006.01]**
22/47 • • • • containing also phosphates **[4, 5, 2006.01]**
22/48 • • • not containing phosphates, hexavalent chromium compounds, fluorides or complex fluorides, molybdates, tungstates, vanadates or oxalates **[4, 5, 2006.01]**
22/50 • • • • Treatment of iron or alloys based thereon **[4, 5, 2006.01]**
22/52 • • • • Treatment of copper or alloys based thereon **[4, 5, 2006.01]**
22/53 • • • • Treatment of zinc or alloys based thereon **[4, 5, 2006.01]**
22/54 • • • • Treatment of refractory metals or alloys based thereon **[4, 5, 2006.01]**
22/56 • • • • Treatment of aluminium or alloys based thereon **[4, 5, 2006.01]**
22/57 • • • • Treatment of magnesium or alloys based thereon **[4, 5, 2006.01]**
22/58 • • • • Treatment of other metallic material **[4, 5, 2006.01]**
22/60 • • using alkaline aqueous solutions with pH > 8 **[4, 5, 2006.01]**
22/62 • • • Treatment of iron or alloys based thereon **[4, 5, 2006.01]**
22/63 • • • Treatment of copper or alloys based thereon **[4, 5, 2006.01]**
22/64 • • • Treatment of refractory metals or alloys based thereon **[4, 5, 2006.01]**
22/66 • • • Treatment of aluminium or alloys based thereon **[4, 5, 2006.01]**
22/67 • • • • with solutions containing hexavalent chromium **[4, 5, 2006.01]**
22/68 • • using aqueous solutions with pH between 6 and 8 **[4, 5, 2006.01]**
22/70 • using melts **[4, 2006.01]**
22/72 • • Treatment of iron or alloys based thereon **[4, 2006.01]**
22/73 • characterised by the process **[4, 2006.01]**
22/74 • • for obtaining burned-in conversion coatings **[4, 2006.01]**
22/76 • • Applying the liquid by spraying **[4, 2006.01]**
22/77 • • Controlling or regulating of the coating process **[4, 2006.01]**
22/78 • Pretreatment of the material to be coated **[4, 2006.01]**
22/80 • • with solutions containing titanium or zirconium compounds **[4, 2006.01]**
22/82 • After-treatment **[4, 2006.01]**
22/83 • • Chemical after-treatment **[4, 2006.01]**
22/84 • • Dyeing **[4, 2006.01]**
22/86 • Regeneration of coating baths **[4, 2006.01]**

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) **[4, 2006.01]**
24/02 • by application of pressure only **[4, 2006.01]**
24/04 • • Impact or kinetic deposition of particles **[4, 2006.01]**
24/06 • • Compressing powdered coating material, e.g. by milling **[4, 2006.01]**
24/08 • by application of heat or pressure and heat (C23C 24/04 takes precedence) **[4, 2006.01]**
24/10 • • with intermediate formation of a liquid phase in the layer **[4, 2006.01]**

26/00 **Coating not provided for in groups C23C 2/00-C23C 24/00 [4, 2006.01]**
26/02 • applying molten material to the substrate **[4, 2006.01]**

28/00 **Coating for obtaining at least two superposed coatings either by methods not provided for in a single one of main groups C23C 2/00-C23C 26/00, or by combinations of methods provided for in subclasses C23C and C25D [4, 2006.01]**
28/02 • only coatings of metallic material **[4, 2006.01]**
28/04 • only coatings of inorganic non-metallic material **[4, 2006.01]**

30/00 **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) **[4, 2006.01]**

C23C

C23D ENAMELLING OF, OR APPLYING A VITREOUS LAYER TO, METALS (chemical composition of the enamels C03C)

Subclass index

1/00 Melting or fritting the enamels; Apparatus or furnaces therefor [1, 2006.01]

1/02 • Granulating the melt; Drying the granules **[1, 2006.01]**

Coating with the enamels

3/00 Chemical treatment of the metal surfaces prior to coating (cleaning or de-greasing of metallic objects C23G) **[1, 2006.01]**

5/00 Coating with enamels or vitreous layers [1, 4, 2006.01]

5/02 • by wet methods **[1, 2006.01]**

5/04 • by dry methods **[1, 2006.01]**

5/06 • producing designs or letters **[1, 2006.01]**

5/08 • Applying enamels non-uniformly over the surface **[1, 2006.01]**

7/00 Treating the coatings, e.g. drying before burning [1, 2006.01]

Firing the enamels

9/00 Ovens specially adapted for firing enamels [1, 2006.01]

9/02 • Non-electric muffle furnaces **[1, 2006.01]**

9/04 • Non-electric tunnel ovens **[1, 2006.01]**

9/06 • Electric furnaces **[1, 2006.01]**

9/08 • Supporting devices for burning-bars **[1, 2006.01]**

9/10 • Loading or unloading devices **[1, 2006.01]**

11/00 Continuous processes for firing enamels; Apparatus therefor [1, 2006.01]

After-treatment

13/00 After-treatment of the enamelled articles [1, 2006.01]

13/02 • Removing defects by local re-melting of the enamel; Adjusting the shape **[1, 2006.01]**

15/00 Joining enamelled articles to other enamelled articles by processes involving an enamelling step [1, 2006.01]

17/00 De-enamelling [1, 2006.01]

C23F NON-MECHANICAL REMOVAL OF METALLIC MATERIAL FROM SURFACES (working of metal by electro-erosion B23H; desurfacing by applying flames B23K 7/00; working metal by laser beam B23K 26/00)**; INHIBITING CORROSION OF METALLIC MATERIAL; INHIBITING INCRUSTATION IN GENERAL** (treating metal surfaces or coating of metals by electrolysis or electrophoresis C25D, C25F)**; MULTI-STEP PROCESSES FOR SURFACE TREATMENT OF METALLIC MATERIAL INVOLVING AT LEAST ONE PROCESS PROVIDED FOR IN CLASS C23 AND AT LEAST ONE PROCESS COVERED BY SUBCLASS C21D OR C22F OR CLASS C25 [4]**

Note(s)

1. This subclass covers inhibiting corrosion or incrustation in general, whether of or on metallic or non-metallic surfaces, subject to Note (2) below.
2. This subclass does not cover:
   - protective layers or coating compositions or methods of applying them; these are classified in the appropriate places, e.g. B05, B44, C09D, C10M, C23C;
   - mechanical devices or constructional features of particular articles for inhibiting incrustation; these are classified in the appropriate places, e.g. in pipes or pipe fittings F16L 58/00;
   - articles characterised by being made of materials selected for their properties of resistance to corrosion or incrustation; these are classified in the appropriate places, e.g. turbine blades F01D 5/28.

Subclass index

1/00 Etching metallic material by chemical means [1, 2, 2006.01]

1/02 • Local etching **[1, 2006.01]**

1/04 • • Chemical milling **[1, 2006.01]**

1/06 • Sharpening files **[1, 2006.01]**

1/08 • Apparatus, e.g. for photomechanical printing surfaces **[1, 2006.01]**
1/10 • Etching compositions (C23F 1/44 takes precedence) **[4, 2006.01]**
1/12 • • Gaseous compositions **[4, 2006.01]**
1/14 • • Aqueous compositions **[4, 2006.01]**
1/16 • • • Acidic compositions (C23F 1/42 takes precedence) **[4, 2006.01]**
1/18 • • • • for etching copper or alloys thereof **[4, 2006.01]**
1/20 • • • • for etching aluminium or alloys thereof **[4, 2006.01]**
1/22 • • • • for etching magnesium or alloys thereof **[4, 2006.01]**
1/24 • • • • for etching silicon or germanium **[4, 2006.01]**
1/26 • • • • for etching refractory metals **[4, 2006.01]**
1/28 • • • • for etching iron group metals **[4, 2006.01]**
1/30 • • • • for etching other metallic material **[4, 2006.01]**
1/32 • • • Alkaline compositions (C23F 1/42 takes precedence) **[4, 2006.01]**
1/34 • • • • for etching copper or alloys thereof **[4, 2006.01]**
1/36 • • • • for etching aluminium or alloys thereof **[4, 2006.01]**
1/38 • • • • for etching refractory metals **[4, 2006.01]**
1/40 • • • • for etching other metallic material **[4, 2006.01]**
1/42 • • • containing a dispersed water-immiscible liquid **[4, 2006.01]**
1/44 • Compositions for etching metallic material from a metallic material substrate of different composition **[4, 2006.01]**
1/46 • Regeneration of etching compositions **[4, 2006.01]**

3/00 Brightening metals by chemical means [1, 2, 2006.01]
3/02 • Light metals **[1, 2006.01]**
3/03 • • with acidic solutions **[4, 2006.01]**
3/04 • Heavy metals **[1, 2006.01]**
3/06 • • with acidic solutions **[4, 2006.01]**

4/00 Processes for removing metallic material from surfaces, not provided for in group C23F 1/00 or C23F 3/00 [4, 2006.01]
4/02 • by evaporation **[4, 2006.01]**
4/04 • by physical dissolution **[4, 2006.01]**

11/00 Inhibiting corrosion of metallic material by applying inhibitors to the surface in danger of corrosion or adding them to the corrosive agent [1, 2006.01]
11/02 • in air or gases by adding vapour phase inhibitors **[1, 2006.01]**
11/04 • in markedly acid liquids **[1, 2006.01]**
11/06 • in markedly alkaline liquids **[1, 2006.01]**
11/08 • in other liquids **[1, 2006.01]**
11/10 • • using organic inhibitors **[1, 2006.01]**

Note(s)

In groups C23F 11/12-C23F 11/173, the last place priority rule is applied, i.e. at each hierarchical level, in the absence of an indication to the contrary, a compound is classified in the last appropriate place.

11/12 • • • Oxygen-containing compounds **[1, 2006.01]**
11/14 • • • Nitrogen-containing compounds **[1, 2006.01]**
11/16 • • • Sulfur-containing compounds **[1, 2006.01]**
11/167 • • • Phosphorus-containing compounds **[4, 2006.01]**
11/173 • • • Macromolecular compounds **[4, 2006.01]**
11/18 • • using inorganic inhibitors **[1, 2006.01]**

13/00 Inhibiting corrosion of metals by anodic or cathodic protection [1, 2006.01]
13/02 • cathodic; Selection of conditions, parameters or procedures for cathodic protection, e.g. of electrical conditions **[5, 2006.01]**
13/04 • • Controlling or regulating desired parameters **[5, 2006.01]**
13/06 • • Constructional parts, or assemblies of cathodic-protection apparatus **[5, 2006.01]**
13/08 • • • Electrodes specially adapted for inhibiting corrosion by cathodic protection; Manufacture thereof; Conducting electric current thereto **[5, 2006.01]**
13/10 • • • • Electrodes characterised by the structure (C23F 13/16 takes precedence) **[5, 2006.01]**
13/12 • • • • Electrodes characterised by the material (C23F 13/16 takes precedence) **[5, 2006.01]**
13/14 • • • • • Material for sacrificial anodes **[5, 2006.01]**
13/16 • • • • Electrodes characterised by the combination of the structure and the material **[5, 2006.01]**
13/18 • • • • Means for supporting electrodes **[5, 2006.01]**
13/20 • • • • Conducting electric current to electrodes **[5, 2006.01]**
13/22 • • • • Monitoring arrangements therefor **[5, 2006.01]**

14/00 Inhibiting incrustation in apparatus for heating liquids for physical or chemical purposes (adding scale preventives or removers to water C02F 5/00) **[1, 2, 2006.01]**
14/02 • by chemical means **[1, 2006.01]**

15/00 Other methods of preventing corrosion or incrustation [1, 2006.01]

17/00 Multi-step processes for surface treatment of metallic material involving at least one process provided for in class C23 and at least one process covered by subclass C21D or C22F or class C25 (coating for obtaining at least two superposed coatings either by methods not provided for in a single one of main groups C23C 2/00-C23C 26/00, or by combinations of methods provided for in subclasses C23C and C25D, C23C 28/00) **[1, 4, 2006.01]**

C23G CLEANING OR DE-GREASING OF METALLIC MATERIAL BY CHEMICAL METHODS OTHER THAN ELECTROLYSIS (polishing compositions C09G; detergents in general C11D)

1/00 Cleaning or pickling metallic material with solutions or molten salts (with organic solvents C23G 5/02) **[1, 2006.01]**
1/02 • with acid solutions **[1, 2006.01]**
1/04 • • using inhibitors **[1, 2006.01]**
1/06 • • • organic inhibitors **[1, 2006.01]**
1/08 • • Iron or steel **[1, 2006.01]**
1/10 • • Other heavy metals **[1, 2006.01]**

1/12 • • Light metals **[1, 2006.01]**
1/14 • with alkaline solutions **[1, 2006.01]**
1/16 • • using inhibitors **[1, 2006.01]**
1/18 • • • Organic inhibitors **[1, 2006.01]**
1/19 • • Iron or steel **[4, 2006.01]**
1/20 • • Other heavy metals **[1, 4, 2006.01]**
1/22 • • Light metals **[1, 2006.01]**
1/24 • with neutral solutions **[1, 2006.01]**
1/26 • • using inhibitors **[1, 2006.01]**
1/28 • with molten salts **[1, 2006.01]**
1/30 • • using inhibitors **[1, 2006.01]**
1/32 • • Heavy metals **[1, 2006.01]**
1/34 • • Light metals **[1, 2006.01]**
1/36 • Regeneration of waste pickling liquors **[1, 2006.01]**

3/00 Apparatus for cleaning or pickling metallic material (with organic solvents C23G 5/04) **[1, 2006.01]**

3/02 • for cleaning wires, strips, filaments continuously **[1, 2006.01]**
3/04 • for cleaning pipes **[1, 2006.01]**

5/00 Cleaning or de-greasing metallic material by other methods; Apparatus for cleaning or de-greasing metallic material with organic solvents [1, 2006.01]

Note(s) [4]

In groups C23G 5/02-C23G 5/06, the last place priority rule is applied, i.e. at each hierarchical level, in the absence of an indication to the contrary, classification is made in the last appropriate place.

5/02 • using organic solvents **[1, 2006.01]**
5/024 • • containing hydrocarbons **[4, 2006.01]**
5/028 • • containing halogenated hydrocarbons **[4, 2006.01]**
5/032 • • containing oxygen-containing compounds **[4, 2006.01]**
5/036 • • • having also nitrogen **[4, 2006.01]**
5/04 • • Apparatus **[1, 2006.01]**
5/06 • using emulsions **[4, 2006.01]**