

**C23 COATING METALLIC MATERIAL; COATING MATERIAL WITH METALLIC MATERIAL** (by metallising textiles D06M 11/83; decorating textiles by locally metallising D06Q 1/04); **CHEMICAL SURFACE TREATMENT; DIFFUSION TREATMENT OF METALLIC MATERIAL; COATING BY VACUUM EVAPORATION, BY SPUTTERING, BY ION IMPLANTATION OR BY CHEMICAL VAPOUR DEPOSITION, IN GENERAL** (for specific applications, see the relevant places, e.g. for manufacturing resistors H01C 17/06); **INHIBITING CORROSION OF METALLIC MATERIAL OR INCRUSTATION IN GENERAL** (treating metal surfaces or coating of metals by electrolysis or electrophoresis C25D, C25F) [2]

**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** (applying liquids or other fluent materials to surfaces in general B05; 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; working of metal by the action of a high concentration of electric current on a workpiece using an electrode B23H; metallising of glass C03C; metallising mortars, concrete, artificial stone, ceramics or natural stone C04B 41/00; paints, varnishes, laquers C09D; enamelling of, or applying a vitreous layer to, metals C23D; inhibiting corrosion of metallic material or incrustation in general C23F; single-crystal film growth C30B; details of scanning-probe apparatus, in general G12B 21/00; manufacture of semiconductor devices H01L; manufacture of printed circuits H05K) [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. [4]

COATING USING MOLTEN COATING MATERIAL ..... 2/00 6/00  
SOLID STATE DIFFUSION COATING ..... 8/00 12/00  
COATING BY VACUUM EVAPORATION, SPUTTERING OR ION-IMPLANTATION ..... 14/00  
CHEMICAL COATING ..... 16/00 20/00  
CONTACT PLATING..... 18/00

CHEMICAL SURFACE TREATMENT.....22/00  
COATING USING INORGANIC POWDER..... 24/00  
OTHER COATING, MULTI-LAYER COATING .....26/00, 28/00  
COMPOSITION OF METALLIC COATING MATERIAL .....30/00

**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) [4]

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

- 2/02 . Pretreatment of the material to be coated, e.g. for coating on selected surface areas (C23C 2/30 takes precedence) [4]
- 2/04 . characterised by the coating material [4]
- 2/06 . . Zinc or cadmium or alloys based thereon [4]
- 2/08 . . Tin or alloys based thereon [4]
- 2/10 . . Lead or alloys based thereon [4]
- 2/12 . . Aluminium or alloys based thereon [4]
- 2/14 . Removing excess of molten coatings; Controlling or regulating the coating thickness (controlling or regulating thickness in general G05D 5/02) [4]
- 2/16 . . using fluids under pressure, e.g. air knives [4]
- 2/18 . . . Removing excess of molten coatings from elongated material [4]
- 2/20 . . . . Strips; Plates [4]
- 2/22 . . by rubbing, e.g. using knives [4]
- 2/24 . . using magnetic or electric fields [4]
- 2/26 . After-treatment (C23C 2/14 takes precedence) [4]
- 2/28 . . Thermal after-treatment, e.g. treatment in oil bath [4]

- 2/30 . Fluxes or coverings on molten baths (C23C 2/22 takes precedence) [4]
- 2/32 . using vibratory energy applied to the bath or substrate (C23C 2/14 takes precedence) [4]
- 2/34 . characterised by the shape of the material to be treated (C23C 2/14 takes precedence) [4]
- 2/36 . . Elongated material [4]
- 2/38 . . . Wires; Tubes [4]
- 2/40 . . . Plates; Strips [4]
- 4/00 Coating by spraying the coating material in the molten state, e.g. by flame, plasma or electric discharge** (spraying guns B05B; making alloys containing fibres or filaments by thermal spraying of metal C22C 47/16; plasma guns H05H) [4]
- 4/02 . Pretreatment of the material to be coated, e.g. for coating on selected surface areas [4]
- 4/04 . characterised by the coating material [4]
- 4/06 . . Metallic material [4]
- 4/08 . . . containing only metal elements [4]
- 4/10 . . Oxides, borides, carbides, nitrides, silicides or mixtures thereof [4]
- 4/12 . characterised by the method of spraying [4]
- 4/14 . . for covering elongated material [4]
- 4/16 . . . Wires; Tubes [4]
- 4/18 . After-treatment [4]

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

**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]

8/02 . Pretreatment of the material to be coated (C23C 8/04 takes precedence) [4]

8/04 . Treatment of selected surface areas, e.g. using masks [4]

8/06 . using gases [4]

8/08 . . only one element being applied [4]

8/10 . . . Oxidising [4]

8/12 . . . . using elemental oxygen or ozone [4]

8/14 . . . . . Oxidising of ferrous surfaces [4]

8/16 . . . . using oxygen-containing compounds, e.g. H<sub>2</sub>O, CO<sub>2</sub> [4]

8/18 . . . . . Oxidising of ferrous surfaces [4]

8/20 . . . Carburising [4]

8/22 . . . . of ferrous surfaces [4]

8/24 . . . Nitriding [4]

8/26 . . . . of ferrous surfaces [4]

8/28 . . more than one element being applied in one step [4]

8/30 . . . Carbo-nitriding [4]

8/32 . . . . of ferrous surfaces [4]

8/34 . . more than one element being applied in more than one step [4]

8/36 . . using ionised gases, e.g. ionitriding (discharge tubes with provision for introducing objects or material to be exposed to the discharge H01J 37/00) [4]

8/38 . . . Treatment of ferrous surfaces [4]

8/40 . using liquids, e.g. salt baths, liquid suspensions [4]

8/42 . . only one element being applied [4]

8/44 . . . Carburising [4]

8/46 . . . . of ferrous surfaces [4]

8/48 . . . Nitriding [4]

8/50 . . . . of ferrous surfaces [4]

8/52 . . more than one element being applied in one step [4]

8/54 . . . Carbo-nitriding [4]

8/56 . . . . of ferrous surfaces [4]

8/58 . . more than one element being applied in more than one step [4]

8/60 . using solids, e.g. powders, pastes (using liquid suspensions of solids C23C 8/40) [4]

8/62 . . only one element being applied [4]

8/64 . . . Carburising [4]

8/66 . . . . of ferrous surfaces [4]

8/68 . . . Boronising [4]

8/70 . . . . of ferrous surfaces [4]

8/72 . . more than one element being applied in one step [4]

8/74 . . . Carbo-nitriding [4]

8/76 . . . . of ferrous surfaces [4]

8/78 . . more than one element being applied in more than one step [4]

8/80 . After-treatment [4]

**10/00 Solid state diffusion of only metal elements or silicon into metallic material surfaces [4]**

10/02 . Pretreatment of the material to be coated (C23C 10/04 takes precedence) [4]

10/04 . Diffusion into selected surface areas, e.g. using masks [4]

10/06 . using gases [4]

10/08 . . only one element being diffused [4]

10/10 . . . Chromising [4]

10/12 . . . . of ferrous surfaces [4]

10/14 . . more than one element being diffused in one step [4]

10/16 . . more than one element being diffused in more than one step [4]

10/18 . using liquids, e.g. salt baths, liquid suspensions [4]

10/20 . . only one element being diffused [4]

10/22 . . . Metal melt containing the element to be diffused [4]

10/24 . . . Salt bath containing the element to be diffused [4]

10/26 . . more than one element being diffused [4]

10/28 . using solids, e.g. powders, pastes [4]

10/30 . . using a layer of powder or paste on the surface (using liquid suspensions of solids C23C 10/18) [4]

10/32 . . . Chromising [4]

10/34 . . Embedding in a powder mixture, i.e. pack cementation [4]

10/36 . . . only one element being diffused [4]

10/38 . . . . Chromising [4]

10/40 . . . . . of ferrous surfaces [4]

10/42 . . . . . in the presence of volatile transport additives, e.g. halogenated substances [4]

10/44 . . . . Siliconising [4]

10/46 . . . . . of ferrous surfaces [4]

10/48 . . . . Aluminising [4]

10/50 . . . . . of ferrous surfaces [4]

10/52 . . . more than one element being diffused in one step [4]

10/54 . . . . Diffusion of at least chromium [4]

10/56 . . . . . and at least aluminium [4]

10/58 . . . more than one element being diffused in more than one step [4]

10/60 . After-treatment [4]

**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]**

12/02 . Diffusion in one step [4]

**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** (discharge tubes with provision for introducing objects or material to be exposed to the discharge H01J 37/00) [4]

14/02 . Pretreatment of the material to be coated (C23C 14/04 takes precedence) [4]

14/04 . Coating on selected surface areas, e.g. using masks [4]

14/06 . characterised by the coating material (C23C 14/04 takes precedence) [4]

14/08 . . Oxides (C23C 14/10 takes precedence) [4]

- 14/10 . . . Glass or silica [4]
  - 14/12 . . . Organic material [4]
  - 14/14 . . . Metallic material, boron or silicon [4]
  - 14/16 . . . on metallic substrates or on substrates of boron or silicon [4]
  - 14/18 . . . on other inorganic substrates [4]
  - 14/20 . . . on organic substrates [4]
  - 14/22 . characterised by the process of coating [4]
  - 14/24 . . Vacuum evaporation [4]
  - 14/26 . . . by resistance or inductive heating of the source [4]
  - 14/28 . . . by wave energy or particle radiation (C23C 14/32 C23C 14/48 take precedence) [4]
  - 14/30 . . . . by electron bombardment [4]
  - 14/32 . . . by explosion; by evaporation and subsequent ionisation of the vapours (C23C 14/34 C23C 14/48 take precedence) [4]
  - 14/34 . . Sputtering [4]
  - 14/35 . . . by application of a magnetic field, e.g. magnetron sputtering [5]
  - 14/36 . . . Diode sputtering (C23C 14/35 takes precedence) [4,5]
  - 14/38 . . . . by direct current glow discharge [4]
  - 14/40 . . . . with alternating current discharge, e.g. high-frequency discharge [4]
  - 14/42 . . . Triode sputtering (C23C 14/35 takes precedence) [4,5]
  - 14/44 . . . . by application of high frequencies and additional direct voltages [4]
  - 14/46 . . . by ion beam produced by an external ion source (C23C 14/40 takes precedence) [4]
  - 14/48 . . Ion implantation [4]
  - 14/50 . . Substrate holders [4]
  - 14/52 . . Means for observation of the coating process [4]
  - 14/54 . . Controlling or regulating the coating process (controlling or regulating in general G05) [4]
  - 14/56 . . Apparatus specially adapted for continuous coating; Arrangements for maintaining the vacuum, e.g. vacuum locks [4]
  - 14/58 . After-treatment [4]
- Chemical deposition or plating by decomposition; Contact plating** (solid state diffusion C23C 8/00 C23C 12/00) [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]
  - 16/01 . on temporary substrates, e.g. on substrates subsequently removed by etching [7]
  - 16/02 . Pretreatment of the material to be coated (C23C 16/04 takes precedence) [4]
  - 16/04 . Coating on selected surface areas, e.g. using masks [4]
  - 16/06 . characterised by the deposition of metallic material [4]
  - 16/08 . . from metal halides [4]
  - 16/10 . . . Deposition of chromium only [4]
  - 16/12 . . . Deposition of aluminium only [4]
  - 16/14 . . . Deposition of only one other metal element [4]
  - 16/16 . . from metal carbonyl compounds [4]
  - 16/18 . . from metallo-organic compounds [4]
  - 16/20 . . . Deposition of aluminium only [4]
  - 16/22 . characterised by the deposition of inorganic material, other than metallic material [4]
  - 16/24 . . . Deposition of silicon only [4]
  - 16/26 . . . Deposition of carbon only [4]
  - 16/27 . . . . Diamond only [7]
  - 16/28 . . . Deposition of only one other non-metal element [4]
  - 16/30 . . . Deposition of compounds, mixtures or solid solutions, e.g. borides, carbides, nitrides [4]
  - 16/32 . . . Carbides [4]
  - 16/34 . . . Nitrides [4]
  - 16/36 . . . Carbo-nitrides [4]
  - 16/38 . . . Borides [4]
  - 16/40 . . . Oxides [4]
  - 16/42 . . . Silicides [4]
  - 16/44 . characterised by the method of coating (C23C 16/04 takes precedence) [4]
  - 16/442 . . . using fluidised bed processes [7]
  - 16/448 . . . characterised by the method used for generating reactive gas streams, e.g. by evaporation or sublimation of precursor materials [7]
  - 16/452 . . . . by activating reactive gas streams before introduction into the reaction chamber, e.g. by ionization or by addition of reactive species [7]
  - 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]
  - 16/455 . . characterised by the method used for introducing gases into the reaction chamber or for modifying gas flows in the reaction chamber [7]
  - 16/458 . . characterised by the method used for supporting substrates in the reaction chamber [7]
  - 16/46 . . characterised by the method used for heating the substrate (C23C 16/48, C23C 16/50 take precedence) [4]
  - 16/48 . . by irradiation, e.g. photolysis, radiolysis, particle radiation [4]
  - 16/50 . . . using electric discharges [4]
  - 16/503 . . . . using dc or ac discharges [7]
  - 16/505 . . . . using radio frequency discharges [7]
  - 16/507 . . . . using external electrodes, e.g. in tunnel type reactors [7]
  - 16/509 . . . . using internal electrodes [7]
  - 16/511 . . . using microwave discharges [7]
  - 16/513 . . . using plasma jets [7]
  - 16/515 . . . using pulsed discharges [7]
  - 16/517 . . . using a combination of discharges covered by two or more of groups C23C 16/503 C23C 16/515 [7]
  - 16/52 . . Controlling or regulating the coating process (controlling or regulating in general G05) [4]
  - 16/54 . . Apparatus specially adapted for continuous coating [4]
  - 16/56 . After-treatment [4]
  - 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** (chemical surface reaction C23C 8/00, C23C 22/00); **Contact plating** [4]
- This group covers also suspensions containing reactive liquids and non-reactive solid particles. [4]
- 18/02 . by thermal decomposition [4]

**C23C**

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

**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 (wash primers C09D 5/12) [4]

- (2008.01), C

- 22/54 . . . . Treatment of refractory metals or alloys based thereon [4,5]
- 22/56 . . . . Treatment of aluminium or alloys based thereon [4,5]
- 22/57 . . . . Treatment of magnesium or alloys based thereon [4,5]
- 22/58 . . . . Treatment of other metallic material [4,5]
- 22/60 . . . using alkaline aqueous solutions with pH > 8 [4,5]
- 22/62 . . . Treatment of iron or alloys based thereon [4,5]
- 22/63 . . . Treatment of copper or alloys based thereon [4,5]
- 22/64 . . . Treatment of refractory metals or alloys based thereon [4,5]
- 22/66 . . . Treatment of aluminium or alloys based thereon [4,5]
- 22/67 . . . . with solutions containing hexavalent chromium [4,5]
- 22/68 . . . using aqueous solutions with pH between 6 and 8 [4,5]
- 22/70 . . . using melts [4]
- 22/72 . . . Treatment of iron or alloys based thereon [4]
- 22/73 . . . characterised by the process [4]
- 22/74 . . . for obtaining burned-in conversion coatings [4]
- 22/76 . . . Applying the liquid by spraying [4]
- 22/77 . . . Controlling or regulating of the coating process (controlling or regulating in general G05) [4]
- 22/78 . . . Pretreatment of the material to be coated [4]
- 22/80 . . . with solutions containing titanium or zirconium compounds [4]
- 22/82 . . . After-treatment [4]
- 22/83 . . . Chemical after-treatment [4]
- 22/84 . . . Dyeing [4]
- 22/86 . . . Regeneration of coating baths [4]
- 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; manufacture of composite layers, workpieces or articles by sintering metallic powder B22F 7/00; friction welding B23K 20/12) [4]
- 24/02 . . . by application of pressure only [4]
- 24/04 . . . Impact or kinetic deposition of particles [4]
- 24/06 . . . Compressing powdered coating material, e.g. by milling [4]
- 24/08 . . . by application of heat or pressure and heat (C23C 24/04 takes precedence) [4]
- 24/10 . . . with intermediate formation of a liquid phase in the layer [4]
- 26/00 Coating not provided for in groups C23C 2/00 C23C 24/00 [4]**
- 26/02 . . . applying molten material to the substrate (applying melts to surfaces, in general B05) [4]
- 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 C25C or C25D [4]**
- 28/02 . . . only coatings of metallic material [4]
- 28/04 . . . only coatings of inorganic non-metallic material [4]
- 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]