C25D

PROCESSES FOR THE ELECTROLYTIC OR ELECTROPHORETIC PRODUCTION OF COATINGS; ELECTROFORMING; APPARATUS THEREFOR

Definition statement

This place covers:

Electroforming.

Electroplating, baths therefor.

Electroplating characterized by the process; pretreatment or after-treatment of workpieces.

Electroplating characterized by the article coated.

Electrolytic coating other than with metals.

Electrolytic coating by surface reaction, reforming conversion layers.

Electrophoretic coating.

Electrolytic or electrophoretic production of coating containing embedded materials, e.g. particles, whiskers, wires.

Constructional parts, or assemblies thereof, of cells for electrolytic coating.

Electrolytic coating plants.

Processes and equipment for servicing or operating cells for electrolytic coating

Relationships with other classification places

- Multi-step processes for surface treatment of metallic material involving at least one process provided for in class C23 and at least one process provided for in class C25 are classified in C23F 17/00.
- Coating for obtaining at least two superposed coatings by combination of methods provided for in subclasses C23C and C25D are classified in C23C 28/00.
- The regeneration of process solutions is classified according to the nature of the solution in the relevant places, e.g. C02F 1/46 (treatment of water), C25B 15/08, C25D 21/16, C25D 13/24, C25F 7/02.
- Electrolytic production or recovery of metals and alloys from solutions or melts is classified in C25C
- Processes and apparatuses for electrochemical removal of materials from object, e.g. etching, polishing, brightening are classified in C25F.
- An electrothermal treatment of ores or metallurgical products for obtaining metals or alloys is classified in C22B 4/00 and does not involve an electrolytic process. Alloys as such, prepared by electrolytic methods are classified in C22C

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Metallising textile	D06M 11/83
Decorating textiles by locally metallising	D06Q 1/04
Manufacturing printed circuits using electroplating	H05K 3/18, H05K 3/241

Informative references

Attention is drawn to the following places, which may be of interest for search:

Welding metals by means of an electrolyte	B23K 28/006
Laminating metals	B32B 15/00
Lacquering	B44D
Apparatus for continuously conveying articles into bath	B65G 49/00
Nanostructures	B82B 3/00
Nano-technology for materials or surface science, e.g. nano-composites	B82Y 30/00
Manufacture or treatment of nano-structures	B82Y 40/00
Treatment of water, waste water, or sewage by electrochemical means, e.g. electrolysis	C02F 1/46
Electroless plating	C23C 18/16
Coating for obtaining at least two superposed coatings by combinations of methods provided for in groups C23C 18/16 and C25D 5/00	C23C 18/1653
Chemical conversion coating	C23C 22/00
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 C25D	C23C 28/00
Anodic or cathodic protection	C23F 13/00
Electrolytic etching, polishing, brightening	C25F
Singe crystal growth	C30B
Electrolytic coating of blades, turbines	F01D 5/00
Measuring thickness	G01B
Electrochemical methods of analysis	G01N 27/26
Controlling or regulating	G05B
Magnetic heads	G11B 5/00
Cables, conductors, insulators	H01B, H01R
Capacitors	H01G 9/00
Semiconductors, wafers	H01L 21/00
Solar Cells	H01L 31/00
Installation of electrical cables or lines	H02G
Manufacturing of printed circuit board by metal deposition	H05K 3/18

Special rules of classification

References H05K 3/18, C23F 13/00, and C30B are non-limiting in the subclass C25D. CPC will be updated once this inconsistency in IPC is resolved.

Claims

The subject of claims are completely classified, in the light of the description, using as many entries of the scheme as possible. The various features constituting in combination the subject matter of a claim, i.e. the invention, are given their respective information symbols. An invention information symbol is allocated to the main features of the claim and additional information symbols to the secondary features.

Examples

The claim relates to a fountain plater comprising a shielding device. The subject matter is classified in C25D 17/001 (invention) and C25D 17/008 (invention as well, because the shielding device is most probably the core of the invention).

The claim relates to an electroplating apparatus comprising an ion-exchange membrane and an inert anode. The subject matter is classified in C25D 17/005 (invention) and C25D 17/10 (additional if any well-known inert anode can be used, invention if the examples actually focus on one particular material for the inert anode).

C25D 1/00

Electroforming

Definition statement

This place covers:

Electroforming processes, i.e. processes involving the reproduction or formation of objects by electrodeposition or electrophoresis in which, typically, the deposit does not permanently remain with the base upon which deposition is made.

Apparatuses and devices especially designed for electroforming.

Electrolytic baths especially formulated for electroforming.

Electroformed products

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Layered products comprising essentially metals	B32B 15/00
Nanostructures (AAO)	B82B 3/00
Measuring thickness	G01B
Controlling or regulating	G05B
Cables, conductors, insulators	H01B, H01R
Installation of electrical cables or lines	H02G

Special rules of classification

Subgroups C25D 1/003 - C25D 1/22

- Electroforming of 3D-structures, see C25D 1/003
- Electroforming of nanostructures, e.g. using aluminum AAO templates or arrays, see C25D 1/006
- Electroforming of tubes, wires, mirrors, perforated or foramina's objects, moulds, see C25D 1/02 - C25D 1/10
- Electroforming by electrophoresis, apparatuses for electroforming by electrophoresis, electrophoretically formed products, see C25D 1/12 - C25D 1/18

The criterion "the deposit does not permanently remain with the base upon which deposition is made" does not need to be fulfilled when the base, after deposition of the material, becomes actually irrelevant for the function of the electroformed object.

Examples:

- an electroformed metal foam for which the polymer template is not removed,

- a thick metal casing electroformed on a thin polymer template.

The step of removing the template may also intervene only at a later stage, not explicitly described in the document. For example, a process of manufacturing a peelable thin foil composite comprising a carrier layer, a release layer and a foil layer "electroplated" on the release layer, provides actually an electroformed foil, since the carrier layer will eventually be removed, e.g. after lamination of the foil composite on an insulating circuit board material.

In certain cases, the base may even remain and constitute the final object together with the electroformed part, but wherein it is still more appropriate to speak of electroforming than of electroplating in the sense of C25D 5/00, see the definition of C25D 1/003.

In case of doubt, the document is classified in both C25D 1/00 subgroups and C25D 5/00 subgroups and/or C25D 7/00 subgroups. For example, the process of manufacturing a peelable thin foil composite mentioned above is appropriately classified in both C25D 1/04 and C25D 7/0614.

Baths especially formulated for electroforming are classified in C25D 1/00 in combination with the relevant subgroups C25D 3/02 - C25D 3/665.

When a document is directed to an apparatus or a device for electroforming, the latter is classified in C25D 1/00 (as a hint to specific apparatus features), in combination with the subgroups C25D 1/003 - C25D 1/22.

C25D 1/003

{3D structures, e.g. superposed patterned layers}

Definition statement

This place covers:

Electroforming processes for building high-aspect-ratio structures extending from the surface of the base, wherein it would be inappropriate to describe the product obtained as a coated product in the sense of C25D 7/00 and wherein the 3-D structure and the base will typically form the final product, e.g. a metal spring electroformed on a base by successive masking and deposition steps. However, the high-aspect-ratio structures may finally be removed from the base as well.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

LIGA (German acronym)	Lithographie, Galvanoformung, Abformung process

C25D 1/006

{Nanostructures, e.g. using aluminium anodic oxidation templates [AAO]}

Definition statement

This place covers:

Electroforming of nanostrutures, e.g. electroforming of nanowire arrays using AAO templates.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Anodisation of aluminium for forming AAO templates	C25D 11/045
Manufacture or treatment of nano-structures	B82Y 40/00

Special rules of classification

Nanotubes, nanorings and hollow bodies of nanometric scale are classified in C25D 1/006 in combination with C25D 1/02.

Nanowires, nanostrips and nanofoils are classified in C25D 1/006 in combination with C25D 1/04.

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

AAO	Aluminum Anodic Oxidation

C25D 1/08

Perforated or foraminous objects, e.g. sieves (C25D 1/10 takes precedence)

Definition statement

This place covers:

Perforated objects, e.g. nozzle plates and foraminous objects, e.g. metal foams.

References

Limiting references

This place does not cover:

Moulds; Masks; Masterforms , e.g. mandrels, stampers	C25D 1/10

Informative references

Attention is drawn to the following places, which may be of interest for search:

Apparatus for spraying or atomising liquids or other fluent materials, using ultrasonics, the spray being produced by discharging the liquid or other fluent material through a plate comprising a plurality of orifices	B05B 17/0638
Manufacturing of the nozzle plates for inkjet printing	B41J 2002/062
Orifice plates for injection nozzles of fuel injectors	F02M 61/1853

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Foraminous	A material such as metal screen, netting, fabric, foam, etc. that has openings, holes, punctures, etc. penetrating through its entire depth

C25D 1/10

Moulds; Masks; Masterforms

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Mould; Masks by electrophoretic coating process	C25D 13/00

Special rules of classification

Moulds, masks and masterforms used for electroforming are classified in C25D 1/00.

C25D 1/12

by electrophoresis

Definition statement

This place covers:

Electrophoretic forming processes, i.e. processes involving the reproduction or formation of objects by electrophoretic deposition in which, typically, the deposit does not permanently remain with the base upon which deposition is made.

Apparatus for performing an electrophoretic forming process.

Products obtained by such processes.

Baths for electroforming by electrophoresis.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Electrophoretic coating	C25D 13/00

C25D 3/00

Electroplating: Baths therefor

Definition statement

This place covers:

Baths for electroplating, e.g. solutions, melts.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Electroless plating baths	C23C 18/00
Electrolytic etching, polishing, brightening	C25F

Special rules of classification

Solid electrolytes used for electroplating are classified in C25D 3/00.

Baths especially formulated for electroforming are classified in C25D 1/00 in combination with the relevant subgroups C25D 3/02 - C25D 3/665.

Subject matter relating to both electroplating baths (C25D 3/00) and electroplating processes (C25D 5/00) is classified in both subgroups.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Electroplating	Electrodeposition on a substrate of a firmly adhering metal or metal alloy

C25D 3/02

from solutions (C25D 5/34 - C25D 5/46 take precedence)

Definition statement

This place covers:

Electrolytic solutions for electroplating, aqueous as well as nonaqueous.

Special rules of classification

Subject matter relating to both electroplating baths and electroplating processes is classified in both groups.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Solution	A homogeneous mixture comprising metal cations dissolved in a molecular solvent, e.g. water or an organic solvent.

C25D 3/40

from cyanide baths {, e.g. with Cu+}

Definition statement

This place covers:

Copper electroplating baths containing cyanide ions, e.g. baths containing Cu+ ions as copper source.

C25D 3/56

of alloys

Definition statement

This place covers:

Electrolytic baths for plating alloys.

C25D 3/60

containing more than 50% by weight of tin

Definition statement

This place covers:

Electrolytic baths for plating tin alloys, including tin-phosphorous (Sn-P) alloys.

C25D 3/66

from melts

Definition statement

This place covers:

Electrolytic baths based on melts, fused baths or ionic liquids.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Melt	molten salt or ionic liquid or fused bath

C25D 3/665

{from ionic liquids}

Definition statement

This place covers:

Electrolytic baths based on ionic liquids or deep eutectic solvents, which are liquid at a temperature typically, lower than 100°C, in particular Room Temperature Ionic Liquids (RTILs).

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Ionic liquid	System composed primarily of one type of discrete anion or cation
Deep eutectic solvent	Eutectic mixture containing a variety of anionic and/or cationic species

C25D 5/00

Electroplating characterised by the process; Pretreatment or after-treatment of workpieces

Definition statement

This place covers:

Electroplating processes, i.e. processes of electrolytic coating the substrate with a firmly adhering metallic layer, including the preparation of the workpieces for subsequent electroplating.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Electroforming	C25D 1/00
Selective plating of, spraying of electrolyte for and regulating thickness of conveyed wires, strips or foils, e.g. using masks	C25D 7/06
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 C25D	C23C 28/00
Electrolytic etching, polishing, brightening	C25F
Controlling or regulating	G05B

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Electroplating	Electrodeposition on a substrate of a firmly adhering metal or metal alloy

C25D 5/003

{Electroplating using gases, e.g. pressure influence}

Definition statement

This place covers:

- Processes comprising the use of a gas for controlling the atmosphere above the electrolytic bath, modifying the composition of the bath or agitating the bath
- Processes comprising the control or use of a gas generated at the electrode

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Removal of gases or vapours	C25D 21/04

Special rules of classification

Processes comprising the agitation of the electrolytic bath using a gas are classified in C25D 5/003 in combination with C25D 21/10.

C25D 5/04

Electroplating with moving electrodes

Definition statement

This place covers:

Processes of electroplating with moving electrodes, e.g. moving counter-electrodes.

Special rules of classification

The conveyance of substrates during continuous electroplating processes are classified in C25D 7/06 and/or C25D 17/06.

Processes of electroplating with a moving, e.g. rotating, substrate is classified in C25D 21/10.

C25D 5/06

Brush or pad plating

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Electrodes for pad plating	C25D 17/14

C25D 5/08

Electroplating with moving electrolyte e.g. jet electroplating {(using locally applied jets of electrolyte C25D 5/026)}

Definition statement

This place covers:

- Electroplating processes with moving electrolyte, improving the electroplating reaction at the cathode, or facilitating the operation of the electroplating cell, e.g. by means of a bath recirculation loop,
- Electroplating processes with spraying of the electrolyte or other alternatives to the immersion,
- Electroplating processes comprising the modification of the hydrodynamics of the electroplating cell by means of a flow directing device, such as a baffle or a diffuser.

References

Limiting references

This place does not cover:

Using locally applied jets of electrolyte	C25D 5/026

Informative references

Attention is drawn to the following places, which may be of interest for search:

Spraying of electrolyte on strips or foils	C25D 7/0685
Means or devices for moving the electrolyte	C25D 21/10

Special rules of classification

As far as electroplating is concerned, C25D 5/08 and C25D 21/10 are similar in scope but:

- C25D 5/08 is relevant for classifying certain processes and equipment for which C25D 21/10 is inappropriate: spraying of the electrolyte, laminar flows of the electrolyte etc.
- C25D 21/10 focuses on equipment such as agitators, stirrers, injectors, recirculation pumps, and on the homogenisation of the electrolyte in terms of composition, temperature etc. A claim to a new agitator design is classified in C25D 21/10, not in C25D 5/08.

Electrolyte flow directing devices modifying the hydrodynamics of the plating cell are classified in C25D 5/08 in combination with C25D 17/008.

C25D 5/16

Electroplating with layers of varying thickness

Definition statement

This place covers:

- Electroplating processes wherein the rough aspect of the deposit obtained is purposive.

C25D 5/54

Electroplating of non-metallic surfaces (C25D 7/12 takes precedence)

Definition statement

This place covers:

Electroplating on non-metallic surfaces, e.g. graphite, ceramics, etc.

For example:

- the non-metallic substrates having an electroplating catalyst embedded therein,
- the non-metallic substrate being catalyzed with discrete catalytic cluster seeds prior to electroplating.

References

Limiting references

This place does not cover:

Semiconductors	C25D 7/12

Informative references

Attention is drawn to the following places, which may be of interest for search:

Processes of forming a multilayer coating comprising the steps of plating a first metal layer on the non-metallic substrate by electroless plating and plating a second metal layer on the first metal layer by electroplating	C23C 18/1653
Processes of forming a multilayer coating comprising the step of depositing a first metal layer on the non-metallic substrate, e.g. by physical vapour deposition, prior to electroplating	C23C 28/00

Special rules of classification

Aspects relating to electroplating on plastics or polymers (e.g. filled, catalysed, etc.) are classified in C25D 5/56.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Direct electroplating	Electroplating process comprising the deposition of catalytic cluster seeds on a non-metallic substrate prior to electroplating.

C25D 5/56

of plastics

Definition statement

This place covers:

Electroplating of plastics and polymers, for example:

- The plastic/polymeric material being conductive per se (e.g. polythiophene)
- The plastic/polymeric material being catalyzed with discrete cluster seeds prior to electroplating (so-called direct electroplating process)
- The plastic/polymeric material having an electroplating catalyst embedded therein
- The plastic/polymeric layer covering a conductive substrate being thin enough not to prevent electroplating

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Coating metallic material	C23C

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Direct electroplating	Electroplating process comprising the deposition of catalytic cluster seeds on a non-metallic substrate prior to electroplating.

C25D 7/00

Electroplating characterised by the article coated

Definition statement

This place covers:

Processes of electroplating to form a specific electroplated article. However, certain aspects are directly classified in the relevant subgroups C25D 7/003 - C25D 7/126.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Laminating metals	B32B 15/00
Electroplating wafers comprising a seed layer	C23C 28/02, H01L 21/00
Electroplating solar cells comprising a seed layer	C23C 28/02, H01L 31/00
Electrolytic coating of blades, turbines	F01D 5/00
Magnetic heads	G11B 5/00
Cables, conductors, insulators	H01B 13/0033, H01R
Capacitors	H01G 9/00
Semiconductors, wafers	H01L 21/00

Solar Cells	H01L 31/00
Installation of electrical cables or lines	H02G
Printed circuit board	H05K 3/00

C25D 7/005

{Jewels; Clockworks; Coins}

Definition statement

This place covers:

Electroplated jewels, clockworks, coins.

C25D 7/06

Wires; Strips; Foils

Definition statement

This place covers:

Electroplated wires, strips or foils, apparatuses and processes for electroplating wires, strips or foils.

Special rules of classification

Apparatus for electroplating metallic strips or foils are classified in C25D 7/06 subgroups only when relevant subgroups, e.g. radial cells, are available. If no relevant subgroups are available, then apparatus for electroplating metallic strips or foils are classified in C25D 7/06 or C25D 7/06 and C25D 17/00 subgroups

The group C25D 7/06 is preferably not used. All the aspects are directly classified in the relevant subgroups C25D 7/0607 - C25D 7/0692.

C25D 7/0607

{Wires}

Definition statement

This place covers:

- Electroplated wires
- Apparatuses and processes for electroplating wires

Special rules of classification

Apparatuses for electroplating wires are classified in C25D 7/0607 in combination with any relevant subgroups under C25D 17/00 and C25D 21/00.

Processes for electroplating wires are classified in C25D 7/0607 in combination with any relevant subgroups under C25D 5/00 and C25D 21/00.

C25D 7/0614

{Strips or foils}

Definition statement

This place covers:

- Electroplated strips, foils, sheets, plates, (cloth) webs, tapes and other elongated flexible strip-shaped articles (such as those having an indeterminate length)
- Apparatuses and processes for electroplating the aforementioned articles

Special rules of classification

Flat articles

In case of ambiguity regarding the characteristics "elongated" and "flexible" of a flat article, the latter is classified in both C25D 7/00 (or lower) and C25D 7/0614 and the corresponding apparatus/process is classified in both C25D 7/0614 (or lower) and C25D 17/00 (or lower).

In any case, the occurrence of one of the terms "sheet", "strip" or "foil" should normally result in the classification of the document in C25D 7/0614 (or lower).

Rods, beams, flat works, boards (e.g. rigid PCBs) are classified in C25D 7/00.

Apparatuses

Apparatuses for electroplating elongate flexible strip-shaped articles are classified in the relevant subgroups C25D 7/0614 - C25D 7/0692.

The following subgroups under C25D 17/00 are used for classifying apparatuses for electroplating strip-shaped articles in combination with the subgroups C25D 7/0614 - C25D 7/0692.

Apparatuses for electroplating rods, beams, flat works, boards (e.g. rigid PCBs) are classified in C25D 17/00.

C25D 17/004: sealing devices, C25D 17/005: contacting devices, but C25D 7/0657 takes precedence for conducting rolls, C25D 17/007: current conducting devices (i.e. thief electrodes, etc.), C25D 17/008: current insulating devices (i.e. shielding devices, virtual anodes, etc.), C25D 17/02 and C25D 17/04: tanks and external supporting frames or structures, C25D 17/10 and C25D 17/12: electrodes, but C25D 7/0642 takes precedence for anodes.

The following subgroup under C25D 17/00 is not used for classifying apparatuses for electroplating strip-shaped articles: C25D 17/002: since C25D 7/065 takes precedence.

The subgroups under C25D 21/00 are used for classification in combination with the subgroups C25D 7/0614 - C25D 7/0692.

Processes

Processes for electroplating elongate flexible strip-shaped articles are classified in the relevant subgroups C25D 7/0614 - C25D 7/0692 in combination with any relevant subgroups under C25D 5/00 and C25D 21/00.

The following subgroups under C25D 5/00 are not used for classifying processes for electroplating strip-shaped articles: C25D 5/02, since C25D 7/0671 takes precedence,

C25D 5/022, since C25D 7/0678 takes precedence.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "sheet", "foil", "plate", "elongated flexible strip-shaped article"

with the additional restrictions that a foil is very thin (e.g. thickness < 0.20 mm) and a strip of a limited width (e.g. < 600 mm).

C25D 7/10

Bearings

Definition statement

This place covers:

Electroplated antifriction means as balls or rollers, designed to receive a rotating shaft, or to be used in connection with a pivoted, sliding, or rotary element.

C25D 7/12

Semiconductors

Definition statement

This place covers:

Details of processes of electroplating semiconductor substrates or devices, such as silicon wafers.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Manufacture of electrodes on semiconductor bodies using an external electrical current, i.e. electro-deposition	H01L 21/2885

Special rules of classification

Processes of electroplating semiconductor substrates or devices first coated with a seed layer prior to electroplating are classified in C25D 7/123.

C25D 7/123

{Semiconductors first coated with a seed layer or a conductive layer}

Definition statement

This place covers:

Details of processes of electroplating semiconductor substrates or devices, such as silicon wafers, including a seed layer or a conductive layer deposited prior to electroplating.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Seed layer	A thin conductive film providing a low resistance conduction path for the plating current that drives the electroplating process, and functioning as a nucleation layer for metal film growth during electroplating. The seed layer acts as the plating base and an underlying adhesion or barrier layer and is typically deposited using sputtering, evaporation, chemical vapour deposition or electroless plating.

C25D 7/126

{for solar cells}

Definition statement

This place covers:

Details of processes of electroplating peculiar to the manufacture of solar cells, including a seed layer or a conductive layer deposited prior to electroplating.

References

Application-oriented references

Examples of places where the subject matter of this place is covered when specially adapted, used for a particular purpose, or incorporated in a larger system:

Processes or apparatus peculiar to the manufacture or treatment of semiconductor devices sensitive to radiation and adapted either for the conversion of the energy of such radiation into electrical energy or for the control of electrical energy by such radiation	H01L 31/18

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Seed layer	A thin conductive film providing a low resistance conduction path for the plating current that drives the electroplating process, and functioning as a nucleation layer for metal film growth during electroplating. The seed layer acts as the plating base and an underlying adhesion or barrier layer and is typically deposited using sputtering, evaporation, chemical vapour deposition or electroless plating.

C25D 9/00

Electrolytic coating other than with metals (C25D 11/00, C25D 15/00 take precedence; electrophoretic coating C25D 13/00)

Definition statement

This place covers:

Processes of electrolytic coating with other materials than metals.

Apparatuses specially adapted for electrolytic coating other than with metals.

Articles electrolytically coated other than with metals.

References

Limiting references

This place does not cover:

Electrolytic coated by surface reaction, i.e. forming conversion layers	C25D 11/00
Electrophoretic coating	C25D 13/00
Electrolytic or electrophoretic production of coatings containing embedded materials	C25D 15/00

Informative references

Attention is drawn to the following places, which may be of interest for search:

Plating of hydroxyapatite, for dental implants	A61L 27/32, A61K 6/887
Lacquering	B44D
Measuring thickness	G01B
Controlling or regulating	G05B

Special rules of classification

When a document is directed to an apparatus or a device for electrolytic coating other than with metals, the latter is classified in C25D 9/00 (as a "tag" referring to apparatus features), in combination with any of the subgroups C25D 9/02 - C25D 9/12, if relevant for the process/product, and any of the subgroups C25D 17/001 - C25D 17/28, if relevant for the apparatus. C25D 21/00 and the subgroups thereof are also available for further classification of apparatus and/or process aspects.

C25D 9/02

with organic materials

Definition statement

This place covers:

Processes of electrolytic coating with organic materials, e.g. by electrografting.

Articles obtained by such processes.

Relationships with other classification places

Compositions for electrophoretic coating of polymers are classified in C09D 5/44.

Compositions for electrophoretic coating of polymers, comprising polymerization in situ, i.e. electropolymerization are classified in C09D 5/4476.

Special rules of classification

Since the processes involving the electrolysis of water and the protonation/deprotonation of organic compounds at the electrodes are covered by the groups under C25D 13/00 and C09D 5/44, the number of processes to be classified in C25D 9/02 is inherently limited. See the glossary of terms under C25D 13/00.

Electrophoretic coating with low molecular weight organic compounds is classified in C25D 13/04.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Electrografting	Electrochemical modification of conducting and semi-conducting surfaces, wherein activated moieties are formed in the vicinity of the electrode from electroactive molecules present in the electrolyte, leading to the formation of strong chemical bonds between the molecules and the electrode.

C25D 9/04

with inorganic materials

Definition statement

This place covers:

Electrolytic coating with inorganic materials, upon partial reduction/oxidation of the source of material to a lower/higher valence state to be deposited or upon variation of the conditions, e.g. variation of the pH further to the electrolysis of water at the working electrode, thereby inducing precipitation of the material.

Special rules of classification

C25D 9/04 relates to the electrolytic coating by deposition, not by surface reaction.

If the material of the surface of the substrate explicitly participates to the formation of the coating by surface reaction, and is eventually present in the coating formed, such a conversion process is classified under C25D 11/00, not under C25D 9/00.

In case of doubt concerning a possible surface reaction, the process is classified in C25D 9/04 (or any of the relevant subgroups) in combination with C25D 11/00 (or any of the relevant subgroups).

C25D 9/06

by anodic processes

Definition statement

This place covers:

Electrolytic coating with inorganic materials by anodic processes, e.g. an anodic coating process comprising the formation of a film comprising nickel in an average valence state between +2 and +4 from a solution containing NiSO4.

Special rules of classification

Anodisation is classified in C25D 11/02.

Chromatizing, anodic chromating or anodic chromate treatment, when it results in the presence of the metal of the substrate in the coating is classified in C25D 11/36.

C25D 9/08

by cathodic processes

Definition statement

This place covers:

Electrolytic coating with inorganic materials by cathodic processes, e.g. a process comprising the electro-reduction of SiCl4 to silicon on a copper substrate.

C25D 11/00

Electrolytic coating by surface reaction, i.e. forming conversion layers

Definition statement

This place covers:

Electrolytic coating by surface reaction with formation of conversion layers, which often serve as passivation layers. However, certain processes are directly classified in the relevant subgroups C25D 11/02-C25D 11/38, e.g. anodisation of refractory metals are classified in C25D 11/26.

- Processes of electrolytic coating by surface reaction with formation of conversion layers
- Apparatuses specially adapted for electrolytic coating by surface reaction
- Articles coated by electrolytic conversion

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Electroplating with an oxide, not a conversion of the surface	C25D 9/00
Coating with an oxide by electromigration of charged particles	C25D 13/02
Chemical surface treatment of metallic material by reaction of the surface (chemical conversion), like phosphatising or chromatising	C23C 22/00
Electrolytic removal of materials (etching, polishing, cleaning)	C25F
Controlling or regulating	G05B
Semiconductors, wafers	H01L 21/00

Synonyms and Keywords

In patent documents, the following abbreviations are often used:

AAO	Aluminum Anodic Oxidation
ANOF	Anodic oxidation by spark discharge

In patent documents, the following words/expressions are often used as synonyms:

- "anodic oxidation", "anodisation", "electrochemical conversion coating"

C25D 11/005

{Apparatus specially adapted for electrolytic conversion coating (apparatus in general for electrolytic coating C25D 17/00)}

Definition statement

This place covers:

Apparatus specially adapted for electrolytic conversion coating.

Special rules of classification

When a document is directed to an apparatus specially adapted for electrolytic coating by surface reaction, the latter is classified in C25D 11/005 in combination with any of the subgroups C25D 11/02 - C25D 11/38, if relevant for the process/product, and in combination with any of the

subgroups C25D 17/001 - C25D 17/28, if relevant for the apparatus. C25D 21/00 and subgroups are also available for further classification of apparatus and/or process aspects.

C25D 11/16

Pretreatment {, e.g. desmutting}

Definition statement

This place covers:

Pretreatment of the substrate surface, e.g. by desmutting.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Desmutting	Removal of smut layer formed after etching a metal or an alloy

C25D 11/18

After-treatment, e.g. pore-sealing

Definition statement

This place covers:

After-treatment of electrolytic coated surface, e.g. physical or mechanical after-treatments.

C25D 11/36

Phosphatising

Definition statement

This place covers:

Electrolytic conversion processes comprising the formation of an adherent phosphate coating on a metal substrate by immersion thereof in a suitable aqueous phosphate solution and precipitation of insoluble metal phosphate compounds upon variation of the pH in the vicinity of the substrate, wherein part of the metal substrate reacts with the solution to form the coating. A metal source other than the substrate may be added to the solution (e.g. precipitation of zinc phosphate on steel substrate), thereby limiting the actual contribution of the metal of the substrate to the formation of the coating.

Articles obtained by such processes.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Bath solutions of NiP, CoP, FeP	C25D 3/562

Special rules of classification

The classification in C25D 11/36 implies a surface reaction, typically the acidic/anodic dissolution of the metal surface to form a metal phosphate coating, i.e. a conversion coating.

If the metal of the substrate does explicitly not contribute to the formation of the coating, and no material of the surface is eventually present in the coating formed, such a "pure" precipitation process is classified in any of the subgroups C25D 9/04 - C25D 9/12, not in C25D 11/36.

In case of doubt as to the contribution of the metal of the surface to the formation of the coating, the process is classified in C25D 11/36 in combination with anyone of the subgroups C25D 9/04 - C25D 9/12.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "Phosphating" or "Phosphatising"

C25D 11/38

Chromatising

Definition statement

This place covers:

Processes of coating by electrochemical reaction of hexavalent chromium with a metal surface in the presence of other components, or "activators," in an acid solution. The hexavalent chromium is partially reduced to trivalent chromium during the reaction, with a concurrent rise in pH, forming a complex mixture consisting largely of hydrated basic chromium chromate and hydrous oxides of both chromium and the basis metal. The typical substrate metals to which a chromate conversion coating is applicable are Al, Cd, Cu, Mg, Ag and Zn. Processes are known for Sn as well.

Processes of anodic chromating wherein the coating formed is a mixture of a chromate and an oxide of the coated metal.

Articles obtained by such processes.

Special rules of classification

The classification in C25D 11/38 implies a surface reaction.

If the metal of the substrate does explicitly not contribute to the formation of the coating, and no material of the surface is eventually present in the coating formed, such a "pure" precipitation process is classified in any of the subgroups C25D 9/04 - C25D 9/12, not in C25D 11/38.

In case of doubt as to the contribution of the metal of the surface to the formation of the coating, the process is classified in C25D 11/38 in combination with anyone of the subgroups C25D 9/04 - C25D 9/12.

Cathodic chromating, i.e. cathodic chromate treatment, of steel substrates is classified in C25D 9/10.

C25D 13/00

Electrophoretic coating characterised by the process (C25D 15/00 takes precedence; compositions for electrophoretic coating C09D 5/44)

Definition statement

This place covers:

Processes wherein charged particles or molecules suspended or dissolved in a liquid medium, possibly forming a colloid, migrate under the influence of an electric field and are deposited onto an electrode by coagulation.

References

Limiting references

This place does not cover:

Electrolytic or electrophoretic production of coating containing embedded materials	C25D 15/00
Compositions for electrophoretic coating of polymers	C09D 5/44

Informative references

Attention is drawn to the following places, which may be of interest for search:

Electrolytic coating other than with metals, by deposition of ions, not through electromigration	C25D 9/00
Electrografting	C25D 9/02
Lacquering	B44D
Apparatus for continuously conveying articles into bath	B65G 49/00
Measuring thickness	G01B
Controlling or regulating	G05B

Special rules of classification

Looping references between C09D 5/44 and C25D 13/00 have been identified. Until this inconsistency is resolved, the current classification practice in CPC is as follows:

Coatings compositions comprising polymers or additives for electrophoratic processes are classified in C09D 5/44 and subsubgroups.

Electrophoretic coating characterised by the process comprising inorganic material or organic material not being polymers or non polymerisable compounds are classified in C25D 13/00 and subgroups.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Electrocoating, electropainting, e-coat	Processes called "electrocoating", "electropainting", "e-coat", etc., wherein the first step is the protonation/deprotonation of the low molecular weight organic compound in the bath, followed by the deprotonation and deposition at the cathode (i.e. cataphoretic process with concomitant reduction of H+ at the cathode according to 2H+ + 2e- --> H2) or protonation and deposition at the anode (i.e. anaphoretic process with concomitant oxidation of water at the anode according to H2O --> ½ O2 + 2e-). Strictly speaking, such processes should be called "electrolytic" instead of "electrophoretic" because the films are not formed by coagulation, but by reaction at the working electrode. However, C25D 13/00 and C09D 5/44 use the expression "electrophoretic coating with polymers" for historical reasons, as generally does the patent and non-patent literature.

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- "Chromating", "chromatizing", "chromate conversion coating"

- "anodic chromating", "anodic chromate treatment"

C25D 13/04

with organic material

Definition statement

This place covers:

The electrophoretic deposition of low molecular weight organic compounds, i.e. non polymeric and non polymerizable compounds.

Relationships with other classification places

Compositions for electrophoretic coating of polymers are classified in C09D 5/44 and subgroups.

Special rules of classification

Since the bath compositions for the electrophoretic deposition of polymers are already classified under C09D 5/44, the classification in C25D 13/04 is restricted to low molecular weight organic compounds.

Electrografting is classified in C25D 9/02.

C25D 13/12

characterised by the article coated

Definition statement

This place covers:

Articles coated by electrophoretic deposition.

C25D 13/18

using modulated, pulsed, or reversing current

Definition statement

This place covers:

Electrophoretic processes using a modulated, pulsed or reversing current, including dielelectrophoretic processes.

Special rules of classification

C25D 13/18 is also used to classify dielectrophoretic deposition processes although the latter are not electrophoretic processes.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Dielectrophoresis	Motion of matter as induced by its polarization in an inhomogeneous electric field, usually into regions of highest field strength, and most evident with neutral matter. The direction of the motion is independent of the sign of the field.
Electrophoresis	Motion of charged matter induced by an electric field. The direction of the motion here is dependent on the sign of the field.

C25D 13/22

Servicing or operating {apparatus or multistep processes}

Definition statement

This place covers:

Equipment and processes for servicing and operating; covering aspects such as heating, cooling, filtering, agitating and process control.

Apparatus specially adapted for the electrophoretic coating process.

Multistep processes.

Details of processes of electrophoretic coating with polymers not classified elsewhere.

C25D 15/00

Electrolytic or electrophoretic production of coatings containing embedded materials, e.g. particles, whiskers, wires

Definition statement

This place covers:

- Processes wherein a matrix of a first material is formed by electrodeposition onto an electrode (see definitions of C25D 5/00 and C25D 9/00) and wherein supplemental substances of at least a second material such as powders, filings, or threads are added to the bath and get entrapped into the matrix upon formation thereof.
- Processes wherein a matrix of a first material is formed on a substrate by an electrolytic coating process involving the reaction of the surface (see definition of C25D 11/00) and wherein supplemental substances of at least a second material such as powders, filings, or threads are added to the bath and get entrapped into the matrix upon formation thereof.
- Processes wherein a matrix of a first material is formed on a substrate by electrophoretic coating (see the definition of C25D 13/00) and wherein supplemental substances of at least a second material such as powders, filings, or threads are added to the liquid and get entrapped into the matrix upon formation thereof.

The coated products obtained by such processes.

C25D 15/02

Combined electrolytic and electrophoretic processes {with charged materials}

Definition statement

This place covers:

Processes involving the formation of a matrix containing supplemental embedded substances (see the definition of C25D 15/00) wherein said supplemental substances are not only passively entrapped in the matrix but are actively involved in an electrophoretic or electrolytic deposition process, e.g. processes wherein the formation of the matrix by electroplating and the migration of the supplemental substances to the cathode by electrophoresis take place concomitantly.

The coated articles obtained by such processes.

C25D 17/00

Constructional parts, or assemblies thereof, of cells for electrolytic coating

Definition statement

This place covers:

Constructional parts, or assemblies thereof, of cells for electrolytic coating.

Electrolytic coating plants.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Apparatus for electroplating wires	C25D 7/0607
Apparatus for electroplating strips or foils	C25D 7/0614
Apparatus specially adapted for electrolytic conversion coating	C25D 11/005
Apparatus for continuously conveying articles into bath	B65G 49/00
Apparatus for electroless plating	C23C 18/1619

Special rules of classification

Electrolytic coating plants are classified in C25D 17/00.

See the special rules of classification within C25D 7/0607, C25D 7/0614 and C25D 11/005.

C25D 17/001

{Apparatus specially adapted for electrolytic coating of wafers, e.g. semiconductors or solar cells}

Definition statement

This place covers:

Apparatus specially adapted for electrolytically coating wafers, such as fountain platers, plating jigs for wafers, etc.

Glossary of terms

In this place, the following terms or expressions are used with the meaning indicated:

Wafer	A thin slice of conductor or semiconductor material

C25D 17/002

{Cell separation, e.g. membranes, diaphragms}

Definition statement

This place covers:

Means such as membranes or diaphrams for dividing the plating cell into a plurality of regions having different bath compositions, e.g. anolyte chamber and catholyte chamber.

Special rules of classification

Current shielding devices are classified in C25D 17/008.

Electroplating of strips or foils in cells comprising a diaphragm are classified in C25D 7/065.

C25D 17/005

{Contacting devices}

Definition statement

This place covers:

Means for electrically contacting the substrate, e.g. electrodes, pins, brushes, etc., e.g. ensuring a uniform current supply to the substrate.

Special rules of classification

Electroplating of strips or foils in cells comprising conducting rolls are classified in C25D 7/0657.

C25D 17/007

{Current directing devices}

Definition statement

This place covers:

Means made of a conductive material in contact with the plating bath, showing an electric potential, thereby modifying the electric field and the current density field in the plating bath.

Those means are often electrically connected to a power supply, as in the case of thief electrodes, auxiliary electrodes, etc., but not necessarily, as in the case of bipolar electrodes.

The current directing device conducts current density lines, contrary to the current shielding device in the sense of C25D 17/008, which acts as an obstacle.

Special rules of classification

Current contacting devices are classified in C25D 17/005.

Current shielding devices are classified in C25D 17/008.

C25D 17/008

{Current shielding devices}

Definition statement

This place covers:

Shielding means, not connected to an electric circuit, for modifying the current density field in the electroplating cell and the current density distribution over the substrate surface, e.g. "diaphragms", "screens", "shields", virtual anodes, for example, to avoid edge effects, etc.

Insulating spacers for avoiding short-circuits and arcing between the substrate and the counter-electrode.

The current shielding device influences the current density field in the plating bath by constituting an obstacle to the current lines in a first region, which normally implies concentrating the current lines in a second region.

The current shielding device is not necessarily made of a dielectric material, but should it be made of a conductive material, it should not act as a current conducting device in the sense of C25D 17/007.

An electrolyte flow directing device (e.g. baffle, damping device, hydrodynamic diffuser, etc.) placed between anode and cathode and aiming at modifying the hydrodynamics of the cell, will normally influence the electric current density distribution as well as the hydrodynamics and is as such also considered as a current insulating device.

Special rules of classification

Cell separation using membranes or diaphragms is classified in C25D 17/002.

Current directing devices are classified in C25D 17/007.

Electroplating of selected surface areas using masking means is classified in C25D 5/022.

Electrolyte flow directing devices are classified in C25D 17/008 in combination with C25D 5/08 (moving electrolyte).

Synonyms and Keywords

In patent documents, the following words/expressions are often used with the meaning indicated:

virtual anode	current shielding device
current shaping element	current shielding device
channeled ionically resistive plate	current shielding device

C25D 17/02

Tanks; Installations therefor

Definition statement

This place covers:

Tanks characterized by their construction material, their shape or by integrated equipment, e.g. sealing devices, windows, integrated cooling or heating devices, etc.

C25D 17/08

{Supporting} racks {, i.e. not for suspending}

Definition statement

This place covers:

Racks, for supporting, not suspending.

C25D 17/10

Electrodes {, e.g. composition, counter electrode}

Definition statement

This place covers:

Counter-electrodes, auxiliary electrodes, thief electrodes, including aspects relating to their composition.

Special rules of classification

Certain working electrodes, such as rotating electrodes used in laboratories, while not being counter-electrodes, can be nevertheless classified in C25D 17/10.

Anodes of cells for electroplating strips or foils are classified in C25D 7/0657.

Electrodes serving for electrically contacting the substrate are classified in C25D 17/005.

The biased substrate to be electrolytically coated is classified in C25D 7/00.

C25D 21/00

Processes for servicing or operating cells for electrolytic coating

Relationships with other classification places

Processes and apparatus for electrolytic production or recovery of metals and alloys from solutions or melts are classified in C25C

Processes and apparatuses for electrochemical removal of materials from object, e.g. etching, polishing, brightening are classified in C25F.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Measuring thickness of coating with piezo, capacity, magnetically	G01B 7/06, G01B 7/08, G01B 7/10
Measuring thickness of coating	G01B 11/06
Measuring thickness of coating with radiation	G01B 15/02
Measuring thickness of coating with sonic vibration	G01B 17/02
pH sensor or regulator	G01N 27/416
Arrangements for measuring current density	G01R 19/08
Process control or regulation in general	G05B

C25D 21/04

Removal of gases or vapours {; Gas or pressure control}

Definition statement

This place covers:

Processes and equipment for the removal of gases or vapours emanating from the electrolytic coating bath, e.g. using a suction hood.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Collecting or removing dirt or fumes, using chambers or hoods covering the area	B08B 15/02

C25D 21/06

Filtering {particles other than ions (filtering ions C25D 21/22)}

Definition statement

This place covers:

Processes and equipment for filtering particles, not ions.

C25D 21/10

Agitating of electrolytes; Moving of racks

Definition statement

This place covers:

Processes and equipment for moving vigorously the aqueous solution for electrolytic coating or for displacing the supports of the article to be treated.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Electroplating with moving electrolyte	C25D 5/08

C25D 21/12

Process control or regulation (controlling or regulating in general G05)

Definition statement

This place covers:

Processes and equipment (architectures, mechanisms and algorithms) for maintaining the output of the electrolytic coating process within a desired range, using open-loop or feedback control. Control and regulation implies that an action is taken during the electrolytic coating process, which results in the modification of a process variable.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Electroplating using modulated, pulsed or reversing current	C25D 5/18

C25D 21/14

Controlled addition of electrolyte components

Definition statement

This place covers:

Processes and equipment (architectures, mechanisms and algorithms) for maintaining the composition of the electrolyte within a desired range during the electrolytic coating process.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Regeneration of electrolytes	C25D 21/18

C25D 21/16

Regeneration of process solutions

Definition statement

This place covers:

Processes and equipment for replenishing and/or purifying spent solutions.

The regeneration can be carried out continuously (using e.g. circulation loops) or in the batch mode.

References

Informative references

Attention is drawn to the following places, which may be of interest for search:

Regeneration of process liquids in electrophoretic coating process	C25D 13/24
Filtering	C25D 21/06
Process control or regulation	C25D 21/12

C25D 21/22

by ion-exchange

Definition statement

This place covers:

Regenerations of process solutions by ion exchange, filtering ions, not particles

Synonyms and Keywords

In patent documents, the following words/expressions are often used as synonyms:

- " regeneration " and " replenish"