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Metallic and other inorganic coatings — Surface treatment, metallic and other inorganic coatings — Vocabulary

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 262, *Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 2080:2008), which has been technically revised.

The main changes compared to the previous edition are as follows:

— new terms have been introduced;

— previous entries have been rationalized;

— some entries have been deleted.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The terms and definitions in this document apply to electroplating and other related surface-finishing processes. The terms and definitions are not necessarily arranged in English alphabetical order. Related terms, giving different alternatives for a given process, have been grouped under a leading term, as, for example, in the case of "chemical plating", "electrodeposition", "blasting", "cleaning" or "colour anodized aluminium".

Basic terms and definitions relating to corrosion and electrochemical techniques used in corrosion science are given in ISO 8044 and are not included. Basic terms used in chemistry, electrochemistry or physics are also not included in this document. The definitions for such terms can be found in handbooks or dictionaries of chemistry or physics.

Metallic and other inorganic coatings — Surface treatment, metallic and other inorganic coatings — Vocabulary

1 Scope

This document defines the terms related to the general types of surface-finishing processes. Emphasis is placed on practical usage in surface-finishing technology in the metal-finishing field.

This document does not include terms for porcelain and vitreous enamel, thermally sprayed coatings and galvanising for which specialized vocabularies and glossaries exist. For the most part, basic terms that have the same meaning in surface finishing as in other fields of technology, and that are defined in handbooks and dictionaries of chemistry and physics, are not included.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 General types of surface-finishing processes and treatments

3.1.1
chemical plating
deposition of a metallic coating by chemical, non-electrolytic methods

3.1.1.1
autocatalytic plating
DEPRECATED: electroless plating
deposition of a metallic coating by a controlled chemical reduction that is catalysed by the metal or alloy being deposited

3.1.1.2
contact plating
deposition of a metal by use of an internal source of current by immersing the *work* (3.2.218) in contact with another metal in a solution containing a compound of the metal to be deposited

3.1.1.3
immersion coating
metallic coating produced by a displacement reaction in which one metal displaces another from a solution

EXAMPLE $Fe + Cu^{2+} \rightarrow Cu + Fe^{2+}$

3.1.2
chemical vapour deposition
CVD
deposition of a coating by a chemical reaction, induced by heat or gaseous reduction of vapour condensing on a *substrate* (3.2.205)

3.1.3
conversion coating
conversion layer
coating obtained by *conversion treatment* (3.1.4)

3.1.4
conversion treatment
chemical or electrochemical process producing a superficial layer containing a compound of the *substrate* (3.2.205) metal

EXAMPLE *Passivation* (3.2.163) coatings on zinc and zinc alloys; aluminium and phosphate coatings on steel; *chromate conversion coatings* (3.2.72).

Note 1 to entry: *Anodizing* (3.2.10) although fulfilling the above definition, is not normally referred to as a conversion coating process.

3.1.5
diffusion treatment
diffusion coating
process of producing a surface layer (diffusion layer) by diffusion of another metal or non-metal into the surface of the *substrate* (3.2.205)

EXAMPLE For *electroplating* (3.1.6): Diffusion treatment to form an alloy coating from two or more different electroplated coatings.

For non-electroplating: *Galvanising* (3.1.7), nitriding, carburizing, *sherardizing* (3.1.15) are diffusion treatments.

Note 1 to entry: Post-coating *heat treatment* (3.2.128) after electroplating, for example, to remove hydrogen, is not normally designated as a diffusion treatment.

3.1.6
electroplating
electrodeposition
deposition of an adherent coating of a metal or an alloy upon a *substrate* (3.2.205) by electrolysis for the purpose of imparting properties or dimensions to a surface different from those of the *basis material* (3.2.29)

3.1.7
galvanising
formation of either a coating of zinc or zinc-iron alloys, or both, on iron and steel products by dipping prepared steel or cast iron in a zinc melt

3.1.8
hot dip metal coating
metallic coating obtained by dipping the basis metal into a molten metal

Note 1 to entry: The traditional term "*galvanising*" (3.1.7) referring to zinc coatings obtained by immersion in a bath of molten zinc, should always be preceded by "hot dip". The term "spelter galvanising" should not be used for "hot dip metal coating". For details of terms and definitions concerning "hot dip galvanising", appropriate standards related to that process are to be consulted.

3.1.9
mechanical coating
mechanical plating
process whereby hard, small spherical objects such as a glass shot are tumbled against a metallic surface, in the presence of finely divided metal powder such as zinc dust and appropriate chemicals for the purpose of covering such surfaces with metal

Note 1 to entry: The terms "peen plating" and "mechanical *galvanising*" (3.1.7) are not recommended.

3.1.10
metal cladding
application of a coating of one metal to another by mechanical fabrication techniques

3.1.11
metallizing
application of a metallic coating to the surface of non-metallic or non-conducting materials

Note 1 to entry: This term shall not be used as a synonym of *metal spraying* (3.1.12) or in the sense of depositing a metallic coating on a metal *substrate* (3.2.205).

3.1.12
metal spraying
application of a metal by thermal *spraying* (3.1.17)

3.1.13
porcelain enamelling
vitreous enamelling
process for applying a substantially vitreous or glassy inorganic coating bonded to metal by fusion at a temperature above approximately 425 °C

3.1.14
physical vapour deposition
PVD
process of depositing a coating by vaporizing and subsequently condensing an element or compound, usually in a high vacuum

Note 1 to entry: See *sputtering* (3.2.196) and *ion plating* (3.2.136).

3.1.15
sherardizing
zinc *diffusion coating* (3.1.5) process or *diffusion treatment* (3.1.5) to form a zinc alloy with the basis metals by heating the *substrate* (3.2.205) with zinc

Note 1 to entry: Mainly used to form a zinc-iron alloy layer on a steel substrate.

3.1.16
surface treatment
treatment involving a modification of the surface

3.1.17
thermal spraying
application of a coating by a process of projecting molten or heat-softened material from a source (gun) onto any *substrate* (3.2.205)

3.1.18
zinc flake coating
coating containing metallic flakes (predominantly zinc) in a suitable binder, non-electrolytically applied on fasteners and other parts by immersion or spraying, followed by *curing* (3.2.36)

Note 1 to entry: The term *base coat* (3.2.27) is often used as a synonym for zinc flake coating in cases where an additional *top coat* (3.1.19) is applied.

3.1.19
top coat
additional layer with or without integral *lubricant* (3.2.142) applied on the *substrate* (3.2.205) in order to achieve functional properties such as additional corrosion protection, torque-tension performance, colour, chemical resistance

Note 1 to entry: Thickness of top coat layer is usually about 3 µm to 10 µm.

Note 2 to entry: Application of a top coat requires totally dried substrate.

Note 3 to entry: See *sealant* (3.2.186).

3.2 Terms used in the industry

3.2.1
acceleration
increase of the rate of a coating process by the use of chemical *additives* (3.2.3)

3.2.2
activation
elimination of a passive surface condition

3.2.3
addition agent
additive
substance added to a solution, usually in small amounts, to modify the characteristics of the solution or the properties of the deposit obtained from the solution

3.2.4
adhesion
amount of force required to separate different layers of a coating, or a coating from its *substrate* (3.2.205) and the area of the corresponding surface

3.2.5
anode corrosion
gradual dissolution or oxidation of a metal (known as anode), or dissolution of an anode material by the electrochemical action in the *electroplating* (3.1.6) cell

Note 1 to entry: The dissolution of the anode by chemical action of the *electrolyte* (3.2.112) without current is generally not called corrosion, but dissolution.

3.2.6
anode film
<anode itself> outer layer of the anode itself consisting of oxidation or reaction products of the anode metal

3.2.7
anode film
<solution in contact with the anode> layer of solution in contact with the anode that differs in composition from the bulk of the solution

3.2.8
anodic oxidation coating
protective, decorative or functional coating composed mainly of metal oxide formed on a metal surface (typically aluminium) by anodically polarising the metal in a suitable *electrolytic solution* (3.2.112)

3.2.9
anodic coating
metallic coating that is less noble than the basis metal

Note 1 to entry: Anodic coatings provide *cathodic protection* (3.2.35).

3.2.10
anodic oxidation
anodizing
electrolytic oxidation process in which the surface of a metal, when anodically treated, is converted to a coating having desirable protective, decorative or functional properties

Note 1 to entry: See *anodic oxidation coating* (3.2.8).

3.2.11
anodic protection
anodic corrosion protection
protection of selected metals by externally applied current

EXAMPLE Stainless steel.

Note 1 to entry: The metal to be protected is polarized as the anode thus causing *passivity* (3.2.165) to the metal protecting it from corrosion.

Note 2 to entry: Anodic protection requires external current supply as contact between different metals (galvanic corrosion) cannot supply enough voltage. See *cathodic protection* (3.2.35).

3.2.12
anodizing line
total process on a production line which includes *anodic oxidation* (3.2.10)

3.2.13
anolyte
portion of the *electrolyte* (3.2.112) on the anode side of the *diaphragm* (3.2.99) in a *divided cell* (3.2.101)

3.2.14
anti-pitting agent
addition agent (3.2.3) for the specific purpose of preventing gas *pits* (3.2.170) in electrodeposits

Note 1 to entry: See *wetting agent* (3.2.216).

3.2.15
automatic machine
conveyer
<electroplating> machine for mechanically processing parts through treatment cycles, such as *cleaning* (3.2.74), anodizing (3.2.10) or *electroplating* (3.1.6)

3.2.16
fully-automatic treatment
automatic treatment in which the *work pieces* (3.2.218) are automatically conveyed through successive *cleaning* (3.2.74) and plating tanks

3.2.17
semi-automatic treatment
automatic treatment in which the *work pieces* (3.2.218) are conveyed automatically through only one plating tank

3.2.18
auxiliary anode
supplementary anode employed during *electrodeposition* (3.1.6) to achieve a desired thickness distribution of the electrodeposit

3.2.19
auxiliary cathode
thief
robber
cathode (3.2.64) placed so as to divert to itself some portion of the current from portions of the *work pieces* (3.2.218) which otherwise receive a too high *current density* (3.2.89)

3.2.20
hydrogen embrittlement relief treating
treatment to reduce the risk of the occurence of hydrogen embrittlement (3.2.130)

3.2.21
mechanical barrel burnishing
smoothing of surfaces by *tumbling* (3.2.210) the *work pieces* (3.2.218) in rotary barrels in the presence of metallic or ceramic shots or balls, and in the absence of an abrasive

3.2.22
barrel electroplating
electroplating (3.1.6) process in which electrodeposits are applied to articles in bulk in a rotating, oscillating or otherwise moving container

3.2.23
barrel finishing
bulk processing in barrels, in either the presence or absence of abrasives or *burnishing* (3.2.60) shot for the purpose of improving the surface *finish* (3.2.119)

Note 1 to entry: See *tumbling* (3.2.210).

3.2.24
barrel processing
mechanical, chemical, autocatalytic or electrolytic treatment of articles in bulk in a rotating or otherwise oscillating container

3.2.25
barrier layer
<anodic oxidation coating> non-porous part of an *anodic oxidation coating* (3.2.8) that separates the *pores* (3.2.173) from the aluminium metal and has a thickness proportional to the bath voltage

3.2.26
barrier protection
coating of a *substrate* (3.2.205) by a more *noble metal* (3.2.157) than the substrate or other material (e.g. lacquer), thus protecting the *basis material* (3.2.29) of the *work* (3.2.218) from corrosion by a closed *barrier layer* (3.2.25), the protection is lost in case of coating damage

EXAMPLE Nickel and chromium on steel substrate; copper, nickel and chromium on steel or zinc substrate.

Note 1 to entry: See *anodic protection* (3.2.11).

3.2.27
base coat
<liquid> suspension of inorganic binder containing metal flakes as the first layer of a coating on to which other coatings are applied

3.2.28
base coat
<solid> layer of metal flakes and binders to which other coatings are applied

Note 1 to entry: Typical *substrates* (3.2.205) for *top coat* (3.1.19) application are *zinc flake coating* (3.1.18), zinc or zinc/nickel alloy coating with or without *passivation* (3.2.163), and/or *sealant* (3.2.186).

3.2.29
basis material
base metal
material upon which coatings are deposited

Note 1 to entry: See *substrate* (3.2.205).

3.2.30
bipolar electrode
electrode that is not directly connected to the power supply but is so placed in the solution between the anode and the *cathode* (3.2.64) that the part nearest to the anode becomes cathodic and the part nearest to the cathode becomes anodic

3.2.31
black oxide
black finishing
blackening
finish (3.2.119) on metal produced by immersing it in hot oxidizing salts or salt solution, or in mixed acid or alkaline solutions

3.2.32
blasting
process whereby solid metallic, mineral, synthetic resin, vegetable particles or water are projected at high velocity against a *work piece* (3.2.218) for the purpose of *cleaning* (3.2.74) abrading or *shot peening* (3.2.43) the surface

3.2.33
abrasive blasting
process for *cleaning* (3.2.74) or finishing by means of an abrasive directed at high velocity against the *work piece* (3.2.218)

3.2.34
bead blasting
process whereby small spherical glass or ceramic beads are propelled against a metallic surface, carried out either in a dry or wet state

3.2.35
cathodic protection
cathodic corrosion protection
ability of a coating to act as a sacrificial layer, thus protecting the metallic *substrate* (3.2.205) of the *work* (3.2.218) from corrosion in case of coating damage

Note 1 to entry: In some countries, cathodic protection is sometimes misleadingly described as *anodic protection* (3.2.11) as the metallic *substrate* (3.2.205) is protected by an *anodic coating* (3.2.9), for example, zinc or zinc alloy.

3.2.36
curing
process of heating the coating in order to obtain a solid, cross-linked and adherent layer, for example, for *zinc flake coatings* (3.1.18), *sealants* (3.2.186) or *top coats* (3.1.19)

Note 1 to entry: *Drying* (3.2.40) can be included in the curing process or can replace curing.

3.2.37
cut-wire blasting
blasting (3.2.32) with short or cut lengths of metal wire

Note 1 to entry: See *abrasive blasting* (3.2.33).

3.2.38
dry ice blasting
blasting (3.2.32) with solid carbon dioxide particles on the surface of a material

3.2.39
dry-to-touch
condition of coated *work pieces* (3.2.218) in which no visibly discernible material is transferred when they are manually gripped or touched by means of an absorbent material

3.2.40
drying
process eliminating either water or solvent, or both, from the coating, either at room temperature or by heating

Note 1 to entry: Drying does not initiate polymer growth or bonding.

Note 2 to entry: See *curing* (3.2.36).

3.2.41
grit blasting
abrasive blasting (3.2.33) with small irregular pieces of steel or malleable cast iron

Note 1 to entry: In Great Britain, this term can also apply to the use of non-metallic particles of similar shape, for example, silicon carbide or aluminium oxide.

Note 2 to entry: *Blasting* (3.2.32) with sand is forbidden in most countries for reasons of health and safety.

3.2.42
shot blasting
process of modification of a surface by abrasive action of shots of a solid of spherical nature propelled at a relatively high velocity against the *work piece* (3.2.218)

Note 1 to entry: See *abrasive blasting* (3.2.33) and *shot peening* (3.2.43).

3.2.43
shot peening
process in which hard, small spherical objects (e.g. metal shots or ceramic beads) are propelled against a surface to introduce compressive stresses into the surface or for decorative effects

3.2.44
wet abrasive blasting
blasting (3.2.32) with a liquid medium or slurry containing abrasive particles

3.2.45
blister
dome-shaped defect in a coating arising from the loss of *adhesion* (3.2.4) between the coating and the *substrate* (3.2.205)

3.2.46
blistering
flittering
occurrence of small metallic particles or flitters, often aligned with *blisters* (3.2.45) but that can also occur without visual blisters (e.g. as delamination inside the metallic layer)

3.2.47
bloom
visible exudation or efflorescence on a surface

3.2.48
blueing
formation of a very thin blue oxide film on steel, either by heating in air or by immersion in oxidizing solutions

3.2.49
bright dip
solution used to produce a bright surface on a metal

Note 1 to entry: See *chemical brightening* (3.2.69).

3.2.50
bright finish
finish (3.2.119) with a uniform, smooth surface of high reflectivity

3.2.51
bright electroplating
process that produces an electrodeposit having a high degree of specular reflectivity in the as-electroplated condition

3.2.52
bright electroplating range
range of *current densities* (3.2.89) within which an *electroplating* (3.1.6) solution produces a bright deposit under a given or specified set of operating conditions

3.2.53
bright throwing power
measure of the ability of an *electroplating* (3.1.6) solution or a specified set of electroplating conditions to deposit uniformly bright electroplate upon an irregularly shaped *cathode* (3.2.64)

3.2.54
brightener
addition agent (3.2.3) added to an autocatalytic and *electroplating* (3.1.6) solution that leads to the formation of a bright deposit

3.2.55
bronzing
application of a chemical *finish* (3.2.119) to copper and copper alloy surfaces or to copper and copper alloy electroplated coatings which alter the colour

Note 1 to entry: Bronzing is not to be confused with *electrodeposition* (3.1.6) of bronze.

3.2.56
brush electroplating
method of *electroplating* (3.1.6) in which the solution is applied with a pad or brush, within which is the anode and that is moved over the *cathode* (3.2.64) to be electroplated

3.2.57
brush electropolishing
method of *electropolishing* (3.2.114) in which the solution is applied with a pad or brush, within which is a *cathode* (3.2.64) and that is moved over the surface (anode) to be polished

3.2.58
buffer
solution with chemicals which are only partially dissociated in solution and which are added to a solution in order to reduce the effect of additions of acids or alkali to its pH value

3.2.59
buffing
smoothing of a surface by mechanical means with or without the addition of abrasive or non-abrasive particles

3.2.60
burnishing
smoothing of surfaces by rubbing, essentially under pressure, rather than the removal of the surface layer

3.2.61
burn-off
unintentional removal of an autocatalytic deposit from a non-conducting *substrate* (3.2.205) during subsequent *electroplating* (3.1.6) operations, due to the application of excess current or to a poor contact area

3.2.62
burnt deposit
rough, non-coherent or otherwise unsatisfactory electrodeposit produced by the application of an excessively high *current density* (3.2.89) usually containing oxides or other inclusions

3.2.63
busbar
rigid conductor for carrying current, for example, to anode and *cathode* (3.2.64) bars

3.2.64
cathode
electrode at which reduction occurs

3.2.65
cathode efficiency
proportion of the total *cathode* (3.2.64) current which is used in depositing the metal concerned

3.2.66
cathode film
layer of solution in contact with the *cathode* (3.2.64), that differs in composition from the bulk of the solution

3.2.67
catholyte
electrolyte (3.2.112) solution adjacent to the *cathode* (3.2.64), i.e. the portion of the electrolyte on the cathode side of the *diaphragm* (3.2.99) in a *divided cell* (3.2.101)

3.2.68
chelating agent
chemical compound that combines with a metal to form a chelate, which is a chemical compound in which metallic and non-metallic, usually organic, groups are combined

3.2.69
chemical brightening
non-electrolytic chemical process to produce a *bright finish* (3.2.50) on a metal surface

Note 1 to entry: See *bright dip* (3.2.49).

Note 2 to entry: Chemical brightening is not to be confused with *chemical polishing* (3.2.71).

3.2.70
chemical milling
shaping of a *work piece* (3.2.218) by immersion in an *etchant* (3.2.117)

Note 1 to entry: A *resist* (3.2.182) or mask can be employed for selective removal of material.

3.2.71
chemical polishing
improvement in surface smoothness of a metal by immersion in a suitable solution

3.2.72
chromate conversion coating
chromate layer
coating obtained by *chromating* (3.2.73)

Note 1 to entry: See *conversion treatment* (3.1.4).

3.2.73
chromating
process for producing a *chromate conversion coating* (3.2.72) by means of a solution containing chromium compounds in the hexavalent form

Note 1 to entry: When chromium compounds in the trivalent form are used, the term *passivation* (3.2.163) can be used.

3.2.74
cleaning
removal of foreign substances, such as oxides, *scales* (3.2.185) or oil from a surface

3.2.74.1
acid cleaning
cleaning (3.2.74) by means of acid solutions

3.2.74.2
alkaline cleaning
cleaning (3.2.74) by means of alkaline solutions

3.2.74.3
anodic cleaning
electrolytic cleaning (3.2.74.7) in which the *work piece* (3.2.218) to be cleaned is the anode of the cell

3.2.74.4
biological degreasing
process of *cleaning* (3.2.74) a metal using a specific soak cleaner supported by oil-consuming bacteria, usually as an initial step in surface pre-treatment

3.2.74.5
cathodic cleaning
electrolytic cleaning (3.2.74.7) in which the *work piece* (3.2.218) to be cleaned is the *cathode* (3.2.64) of the cell and inert plates (usually steel) are the anodes

3.2.74.6
diphase cleaning
cleaning (3.2.74) using a mixture of an organic solvent layer and a layer of an aqueous solution containing surface active agents, the cleaning being effected both by the solvent and aqueous layers

3.2.74.7
electrolytic cleaning
cleaning (3.2.74) in which direct current is passed through the solution, the *work piece* (3.2.218) to be cleaned being one of the electrodes

Note 1 to entry: See *anodic cleaning* (3.2.74.3) and *cathodic cleaning* (3.2.74.5).

3.2.74.8
emulsifiable solvent cleaning
two-stage *cleaning* (3.2.74) where solvents and surface active agents are applied, emulsified, and, afterwards, removed along with soil by water rinsing

3.2.74.9
emulsion cleaning
cleaning (3.2.74) by means of an emulsified liquid system that consists of an organic solvent, a water phase and *emulsifying agents* (3.2.115)

Note 1 to entry: See *soak cleaning* (3.2.74.11)

3.2.74.10
periodic reverse electrolytic cleaning
method of *electrolytic cleaning* (3.2.74.7) in which the current in the *cleaning* (3.2.74) solution is reversed periodically, the cycles being no longer than several seconds or a few minutes

Note 1 to entry: The *anodic cleaning* (3.2.74.3) cycle is usually of double duration compared to the *cathodic cleaning* (3.2.74.5) cycle.

Note 2 to entry: Periodic reverse electrolytic cleaning is usually *finished* (3.2.120) with an *anodic cleaning* (3.2.74.3) phase at the end.

3.2.74.11
soak cleaning
immersion cleaning
cleaning (3.2.74) by immersion without the use of electric current, usually in a hot alkaline solution containing surfactants

3.2.74.12
solvent degreasing
removal of grease and oil from surfaces by immersion in organic solvents

3.2.74.13
spray cleaning
cleaning (3.2.74) by means of spraying with a cleaning solution

3.2.74.14
ultrasonic cleaning
cleaning (3.2.74) by any chemical means aided by ultrasonic energy

3.2.74.15
vapour degreasing
removal of oil and grease by solvent vapours condensing on the *work pieces* (3.2.218) being cleaned

3.2.75
colour anodizing of aluminium
anodizing (3.2.10) aluminium accompanied by the electrolytic deposition of coloured metallic salts into the *pores* (3.2.173)

3.2.76
dyeing of anodized aluminium
absorption of dyestuffs or pigments into the *pores* (3.2.173) of anodized aluminium, usually at elevated temperature, accompanied by sealing of the pores

Note 1 to entry: See *coloured anodizing of aluminium* (3.2.75).

3.2.77
integral colour anodizing of aluminium
<self-colour anodized aluminium>anodizing of aluminium using an appropriate (usually containing organic based acids) *electrolyte* (3.2.112) which produces a coloured *finish* (3.2.119) during the *anodizing* (3.2.10) process itself

3.2.78
colouring
production of desired colours on metal surfaces or electroplated coatings by appropriate chemical or electrochemical action

3.2.79
colouring off
light *buffing* (3.2.59) of metal surfaces for the purpose of producing a high lustre

3.2.80
complexing agent
compound that combines with metal ions to form complex ions

3.2.81
complex salt
compound of two single salts which crystallize together in a simple molecular ratio

EXAMPLE Complex salts: potassium silver cyanide, KAg(CN).

Complex ions: cuprocyanide ion, $[Cu(CN)_3]^{2-}$.

Note 1 to entry: In aqueous solutions, a complex salt is dissociated into ions (complex ions) giving reactions which are quite distinct from those of the component single salts.

3.2.82
composite coating
dispersion coating
coating consisting of deposits incorporating particles or fibres of another material

Note 1 to entry: When a lower percentage of incorporated particles is given, mainly composite coating is used. When a high percentage of particles is given, usually dispersion coating is used.

3.2.83
conditioning
conversion of a surface to a suitable state for treatment in successive steps

Note 1 to entry: In Europe, this term is reserved for non-conducting *substrates* (3.2.205).

3.2.84
conducting salt
salt added to a solution to increase its electrical conductivity

3.2.85
covering power
ability of an *electroplating* (3.1.6) solution under a specified set of conditions to deposit a closed (continuous) layer of metal on the surfaces of recessed areas or holes

Note 1 to entry: Covering power denotes the ability to form a continuous metal layer on any surface. There is no requirement of a specified layer thickness.

Note 2 to entry: Covering power is not to be confused with *throwing power* (3.2.143).

3.2.86
crack
narrow separation of random dimensions and orientation in a surface coating

3.2.87
crazing
network of fine hairline *cracks* (3.2.86) in a coating

3.2.88
critical current density
<electroplating> *current density* (3.2.89) above or below which, different and sometimes undesirable reactions occur

3.2.89
current density
ratio of the current on a surface of an electrode to the area of that surface

Note 1 to entry: Current density is often expressed in amperes per square decimetres (A/dm^2).

3.2.90
current efficiency
proportion of the current that is effective in carrying out a given process in accordance with Faraday's laws of electrolysis

Note 1 to entry: Current efficiency is usually expressed as a percentage.

3.2.91
deburring
removal of sharp edges and burrs by mechanical, chemical or electrochemical means

3.2.92
degreasing
removal of grease or oil from a surface

Note 1 to entry: See *cleaning* (3.2.74).

3.2.93
deionization
removal of ions

EXAMPLE Removal of ions from a solution by *ion exchange* (3.2.134).

3.2.94
depolarization
decrease in the polarization, the difference of the potential of an electrode from its equilibrium or steady state of an electrode

3.2.95
depolarizer
substance or a means that decreases polarization of an electrode

3.2.96
anionic detergent
cleansing agent that produces aggregates of negatively charged ions with colloidal properties

3.2.97
cationic detergent
cleansing agent that produces aggregates of positively charged ions with colloidal properties

3.2.98
non-ionic detergent
cleansing agent that produces aggregates of electrically neutral molecules with colloidal properties

3.2.99
diaphragm
porous separator that divides the anode and *cathode* (3.2.64) compartments of an *electroplating* (3.1.6) tank from each other or from an intermediate compartment, while allowing the current to flow

3.2.100
dispersing agent
material that increases the stability of a suspension of particles in a liquid medium

3.2.101
divided cell
cell containing a *diaphragm* (3.2.99) or other means for physically separating the *anolyte* (3.2.13) from the *catholyte* (3.2.67)

3.2.102
double salt
compound of two salts that crystallize together in stoichiometric proportions but react as the corresponding single salts in aqueous solution

Note 1 to entry: See *complex salt* (3.2.81).

3.2.103
drag-in
liquid carried into a solution by the objects introduced therein

3.2.104
drag-out
liquid carried out of a solution by the objects removed therefrom

3.2.105
ductility
ability of a coating or a material to deform plastically without fracture

3.2.106
dull finish
finish (3.2.119) essentially lacking both diffuse and specular reflectance

Note 1 to entry: See *matt finish* (3.2.145).

3.2.107
dummy
dummy cathode
cathode (3.2.64) used for the removal of impurities from *electroplating* (3.1.6) solutions by low-current-density electrolysis

3.2.108
electrodeposited metal
<duplex coatings> two-layer system of the same electroplated metal (e.g. nickel) each with different properties

3.2.109
duplex coating
combination of two layers of different materials to give higher corrosion resistance

Note 1 to entry: The layers can be two layers of electroplated metals or can be a plated metal followed by an organic layer.

3.2.110
electrochemical machining
ECM
electrochemical milling
shaping of a metal *work piece* (3.2.218) (anode) by passing a direct electric current through an *electrolyte* (3.2.112) in the gap between it and a suitably shaped tool [*cathode* (3.2.64)] that focuses the current in those areas where preferential metal removal is desired

3.2.111
electrolytic colouring
electrolytic process that produces coloured *finishes* (3.2.119) on basis metal or electroplated metal coatings

Note 1 to entry: Electrolytic colouring is to be differentiated from colour anodizing, *electrolytic (2-step) colour anodizing* (3.2.211) and integral colour anodizing.

3.2.112
electrolyte
electrolytic solution
conducting medium in which the flow of current is accompanied by movement of matter, being most often an aqueous solution of acids, bases or dissolved salts of the metal to be deposited

3.2.113
electroplating range
deposition range
current density (3.2.89) range over which a satisfactory electrodeposit can be obtained

3.2.114
electropolishing
improvement in surface smoothness and brightness of a metal surface by making it anodic in an appropriate solution

3.2.115
emulsifying agent
substance that produces an emulsion or increases its stability

3.2.116
etch
dissolve unevenly a part of the surface of a metal

3.2.117
etchant
solution used for removing material selectively or to *etch* (3.2.116) a surface

3.2.118
filter aid
inert, insoluble material, more or less finely divided, used as a filter medium, or to assist in filtration by preventing excessive packing of the filter cake

3.2.119
finish
appearance of the coating or *basis material* (3.2.29)

Note 1 to entry: See *bright finish* (3.2.50), *dull finish* (3.2.106), *matt finish* (3.2.145) and *satin finish* (3.2.184).

3.2.120
finish
treatment leading to either the appearance or specific properties, or both, of the coating or *basis material* (3.2.29)

3.2.121
flash
flash plate
very thin electrodeposit used for a final coating

Note 1 to entry: The term can only be used for a final coating; for intermediate coating, use the term *strike* (3.2.201).

3.2.122
flocculate
aggregate into larger particles to increase in size to the point where precipitation occurs

3.2.123
flow brightening
melting of a coating followed by solidification, especially of tin and tin-lead alloys

3.2.124
free cyanide
true or actual concentration of cyanide ion, or equivalent alkali cyanide, not combined in complex ions with metals in solution

Note 1 to entry: The calculated concentration of free cyanide, or the concentration of free cyanide can be determined by a specified analytical method.

Note 2 to entry: See *total cyanide* (3.2.210).

3.2.125
grinding
removal of material from the surface of a *work piece* (3.2.218) by means of abrasives contained in, or bonded to, a rigid or flexible holder

Note 1 to entry: Grinding is usually the first step in polishing operations.

3.2.126
hard anodized coating
anodized aluminium where the *anodic oxidation coating* (3.2.8) has been produced with improved wear and corrosion resistance compared to the *substrate* (3.2.205) and standard oxidation coating as its primary characteristics, typically generated by low temperature electrolysis at −5 °C to +5 °C

3.2.127
Haring-Blum cell
rectangular test cell of non-conducting material, with principal and auxiliary electrodes so arranged as to permit an estimation of *throwing power* (3.2.143) or electrode polarization and potential between them

3.2.128
heat treatment
<coatings, basis material> thermal treatments of various kinds for the purpose of modifying either the properties of electrodeposited, autocatalytic and other types of coatings, or the properties of *basis materials* (3.2.29), or both, with alteration of the metallurgical structure

EXAMPLE 1 *Stress-relief heat treatment* (3.2.200) prior to application of coating.

EXAMPLE 2 Hardening of nickel-phosphorus coatings obtained by *autocatalytic plating* (3.1.1.1) after coating.

Note 1 to entry: Hydrogen-embrittlement-relief treatment is dealt with in 3.2.130.3.

3.2.129
Hull cell
trapezoidal test cell of non-conducting material with electrodes arranged to permit the observation of cathodic or anodic effects over a wide range of *current densities* (3.2.89) and compare the characteristics of *electrolytes* (3.2.112)

3.2.130
hydrogen embrittlement
permanent loss of *ductility* (3.2.105) in a metal or alloy caused by atomic hydrogen in combination with either load-induced or residual tensile stress, or both, that can lead to brittle fracture after a period of time

Note 1 to entry: Atomic hydrogen can be absorbed during *electroplating* (3.1.6), *autocatalytic plating* (3.1.1.1), *cathodic cleaning* (3.2.74.5) or acid *pickling* (3.2.169).

Note 2 to entry: Brittle fracture along cleavage planes is known as trans-granular fracture.

Note 3 to entry: Brittle fracture by separation at prior austenite grain boundaries is known as intergranular fracture.

3.2.130.1
internal hydrogen embrittlement
IHE
embrittlement caused by residual hydrogen from manufacturing processes, resulting in delayed brittle failure of the *work piece* (3.2.218) under either load-induced or residual tensile stress, or both

Note 1 to entry: See *baking* (3.2.130.3).

3.2.130.2
environmental hydrogen embrittlement
EHE
embrittlement caused by hydrogen absorbed as atomic hydrogen from a service environment resulting in delayed brittle failure of the *work piece* (3.2.218) under tensile stress (i.e. either load-induced or residual tensile stress, or both)

Note 1 to entry: The hydrogen can be generated by corrosion processes [e.g. *cathodic protection* (3.2.35) mechanism, hydrogen-induced stress corrosion *cracking* (3.2.86)] or from other environmental sources.

3.2.130.3
baking
DEPRECATED: hydrogen-embrittlement-relief heat treatment
DEPRECATED: de-embrittlement
degass process of heating coated *work pieces* (3.2.218) over a temperature range and for a duration of time such that no alteration of metallurgical structures, such as recrystallization of the basis metal occurs, but at which hydrogen desorption is achieved, thus minimizing the risk of *internal hydrogen embrittlement* (3.2.130.1)

Note 1 to entry: See *stress-relief heat treatment* (3.2.200).

3.2.131
insoluble anode
DEPRECATED: inert anode
anode that is insoluble in the *electrolyte* (3.2.112) and is not dissolved under the conditions prevailing during electrolysis

3.2.132
inhibitor
substance, added in small concentrations, that reduces the rate of a chemical or electrochemical reaction, for example in corrosion or *pickling* (3.2.169)

3.2.133
initiation
<electroplating on conductive substrates> initial stage of deposition of a metal on the surface of the *substrate* (3.2.205)

Note 1 to entry: Certain materials such as cast iron or hardened steel frequently show a lack of initiation or delayed start of metal deposition in selected areas or over the entire surface. This can lead to reduced *metal distribution* (3.2.147), poor coverage or even non-plated parts.

3.2.134
ion exchange
reversible process by which ions are interchanged between an *ion exchange resin* (3.2.135) and a liquid without a substantial structural change of the ion exchange resin

3.2.135
ion exchange resin
organic material which can reversibly bind all or selected ions in order to extract them from liquids

Note 1 to entry: Ion exchange resins are typically solid materials, for example, supplied as pearls, but they can also be encapsulated liquids or liquid materials, used for liquid to liquid exchange.

3.2.136
ion plating
process in which either the *substrate* (3.2.205) surface or depositing layer, or both, is subjected to a flux of high-energy particles (usually gas ions) sufficient to cause changes in the interfacial region or in the properties of the film

Note 1 to entry: See *rack plating jig* (3.2.180).

3.2.137
lapping
rubbing two surfaces together with or without abrasives for the purpose of obtaining extreme dimensional accuracy or superior surface *finish* (3.2.119)

3.2.138
levelling
ability of an *electroplating* (3.1.6) process to produce a surface smoother than that of the *substrate* (3.2.205)

Note 1 to entry: See *microthrowing power* (3.2.151).

3.2.139
limiting current density
<electroplating, cathodic> maximum *current density* (3.2.89) at which satisfactory deposits can be obtained

3.2.140
limiting current density
<electroplating, anodic> maximum *current density* (3.2.89) at which the anode behaves without excessive polarization

3.2.141
linishing
graining
directional *grinding* (3.2.125) of flat surfaces by means of an abrasive bonded to an endless flexible belt

3.2.142
lubricant
substance generally used to either adjust or control friction properties of coated fasteners, either integrated in the coating itself or subsequently applied on the coating, or both

Note 1 to entry: *Sealants* (3.2.186) and *top coat* (3.1.19) often have integrated lubricant.

3.2.143
macrothrowing power
throwing power
ability of an *electrolyte* (3.2.112) to approach *uniformity* (3.2.212) of the coating thickness over the entire surface of the *work piece* (3.2.218) including its recesses

Note 1 to entry: Good macrothrowing power does not necessarily imply good *microthrowing power* (3.2.151).

Note 2 to entry: Macrothrowing power is a property of the electrolyte resulting in *metal distribution* (3.2.147) on the substrate.

3.2.144
mandrel
form used as a *cathode* (3.2.64) in electroformingEXAMPLE Mould or matrix.

3.2.145
matt finish
uniform *finish* (3.2.119) of a fine *texture* (3.2.207) with little reflectivity

3.2.146
reference area
surface area that is examined for conformance to one or more specified requirements

3.2.147
metal distribution
ratio of deposited metal over a *cathode* (3.2.64)

Note 1 to entry: The ratio of the thicknesses of deposited metal upon two specified areas of a *cathode* (3.2.64) is defined as the metal distribution ratio.

Note 2 to entry: See *macrothrowing power* (3.2.143).

3.2.148
microcracked chromium
electrodeposited chromium coating with an intentional microscopical *crack* (3.2.86) pattern

3.2.149
microdiscontinuity
microcrack or micropore in coating

3.2.150
microporous chromium
electrodeposited chromium coating with an intentional microscopical *porosity* (3.2.174)

3.2.151
microthrowing power
ability of an *electrolyte* (3.2.112) or a specified set of *electroplating* (3.1.6) conditions to deposit metal in *pores* (3.2.173) or scratches

Note 1 to entry: Good microthrowing power does not necessarily imply good *macrothrowing power* (3.2.143).

3.2.152
millscale
thick oxide layer formed during hot fabrication or *heat treatment* (3.2.128) of certain metals

3.2.153
modulated current electroplating
method of *electroplating* (3.1.6) in which the *cathode* (3.2.64) *current density* (3.2.89) is changed periodically

Note 1 to entry: See *pulse plating* (3.2.178) and *mandrel* (3.2.144).

3.2.154
mopping
smoothing of a surface by means of a rotating flexible wheel, to the surface of which fine, abrasive particles are applied in suspension in a liquid, in the form of a paste or grease stick

Note 1 to entry: A mopped surface is characterized as semi-bright to mirror-bright without pronounced line patterns on the surface.

Note 2 to entry: See *grinding* (3.2.125) and *mechanical polishing* (3.2.172).

3.2.155
morphology
structure and roughness of a surface in micrometre and nanometre scales

3.2.156
multilayer deposit
metallic multilayer deposit
deposit consisting of two or more layers of metal deposited successively, consisting of either different metals or layers of the same metal with different characteristics

3.2.157
noble metal
non-corroding metal or a metal that is resistant to oxidation

EXAMPLE Gold, platinum.

Note 1 to entry: In general, a more noble metal provides better resistance to corrosion and chemical attack than a less noble metal. Nevertheless, it is often impossible, owing to several intervening effects, such as the formation of surface oxide layers, to predict the corrosion behaviour of a metal from its electrode potential alone.

3.2.158
nodule
rounded projection formed on a *cathode* (3.2.64) during *electrodeposition* (3.1.6) that can be seen without magnification

Note 1 to entry: See *trees* (3.2.209).

3.2.159
nucleation
<electroplating on non-conductive substrates> pre-plating step in which a catalytic material is absorbed onto the surface of a *substrate* (3.2.205) to act as sites for the initial stages of deposition

3.2.160
open porosity
discontinuities including holes, *cracks* (3.2.86), *pits* (3.2.170), scratches, voids or any opening in the coating surface exposing either the underlying coating or the basis metal to the environment

3.2.161
orange peel
finish (3.2.119) resembling the dimpled appearance of a citrus fruit

3.2.162
oxidizing agent
substance that causes oxidation of another species, thereby itself becoming reduced

3.2.163
passivation
passivation layer
chemical *conversion layer* (3.1.3) on cathodic protecting metal, either for the purpose of reducing the corrosion rate of the metal coating or for colouration, or both

Note 1 to entry: Passivation is mainly used with chromium compounds in the trivalent form for passivation of zinc or zinc alloy coatings.

Note 2 to entry: Passivation is used with chromium-III, zirconium, titanium and other metal ions for passivation of, for example, aluminium, zinc, zinc alloys and other metals.

3.2.164
passivating of stainless steel
chemical process that increases the thickness of the naturally occurring chromium rich oxide film present on all types of stainless steel surfaces

3.2.165
passivity
passive state
condition of a metal that retards its normal reaction in a specified environment, and associated with the assumption of a potential more noble than its normal potential through formation of a surface barrier film, usually an oxide coating

3.2.166
peeling
detachment or partial detachment of a coating from the *basis material* (3.2.29) or undercoating

3.2.167
periodic reverse electroplating
PR electroplating
method of *electroplating* (3.1.6) in which the current is reversed periodically, the individual reverse cycles being no longer than several seconds

3.2.168
phosphate conversion coating
layer of insoluble phosphates formed on a metal surface by using an agent containing either ortho-phosphoric acid or ortho-phosphates, or both, and, sometimes, other *additives* (3.2.3)

Note 1 to entry: See *conversion treatment* (3.1.4).

3.2.169
pickling
removal of oxides or other compounds from a metal surface by chemical or electrochemical action

3.2.170
pit
small depression or cavity produced on a metal surface during *electroplating* (3.1.6) or by corrosion

3.2.171
polarizer
substance or means that produces or increases polarization (differences of the potential of an electrode from its equilibrium potential, meaning potential with no net reaction)

3.2.172
mechanical polishing
bobbing
smoothing of a metal surface by means of the action of abrasive particles attached by adhesive to the surface of wheels or endless belts, usually driven at high speeds

3.2.173
pore
void in the structure of a coating

3.2.174
porosity
<anodic oxidation coating> ratio of the volume of the *pores* (3.2.173) in a given thickness of *anodic oxidation coating* (3.2.8) to the total volume of the coating in that thickness

3.2.175
porous layer
<anodic oxidation coating> porous part of an *anodic coating* (3.2.9) between the *barrier layer* (3.2.25) and the outer surface of the coating

3.2.176
post-nucleation
<electroplating non-conductive materials> step where, if necessary, the catalyst is converted to its final form, the final step prior to *autocatalytic plating* (3.1.1.1)

3.2.177
primary current distribution
distribution of current over the surface of an electrode that is expected from geometrical considerations alone, in the absence of polarization

3.2.178
pulse plating
method of *electroplating* (3.1.6) in which the current is frequently interrupted or periodically decreased or increased