

Australian Standard™

**Metal finishing—Glossary of terms in
electroplating and related processes**

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The following are represented on Committee MT-009:

Australian Institute of Metal Finishing
Australian Chamber of Commerce and Industry
Australian Industry Group
Department of Defence
Galvanizers Association of Australia
Institute of Materials Engineering Australia
Powder Coaters Association
The Royal Australian Chemical Institute
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STANDARDS AUSTRALIA

RECONFIRMATION
OF
AS 4108—2005
Metal finishing—Glossary of terms in electroplating and related processes

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Australasian Institute of Surface Finishing
Australian Chamber of Commerce and Industry
Australian Industry Group
Australian Steel Institute
Bureau of Steel Manufacturers of Australia
Galvanizers Association of Australia
Galvanizing Association of New Zealand
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NOTES

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PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee MT-009, Metal Finishing, to supersede AS 4108—1993, *Metal finishing—Glossary of terms used in electroplating and related processes*. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian rather than an Australian/New Zealand standard.

This Standard is based on but not equivalent to ISO 2080:1981, *Electroplating and related processes—Vocabulary*. Additional definitions have been included so as to meet Australian industry requirements.

The objective of this revision is to provide a list of current terms used in electroplating and other related industries and to delete the terms from the Standard that have become redundant.

During the revision of this Standard, the Committee considered only those terms in constant use in the electroplating industry in Australia, and which relate to the coating itself.

FOREWORD

Many terms that relate to electroplating and similar industries are known by more than one name. In the case of some defects, the same name may be used by two persons to indicate two entirely different types of defect. Such variations in meaning have led to confusion, especially where writing is the only form of communication in the exchange of ideas.

This Standard concentrates on eliminating this confusion by using the most common terms which are used in Australian industry.

STANDARDS AUSTRALIA

Australian Standard

Metal finishing—Glossary of terms in electroplating and related processes

Term	Definition
abrasion blast-cleaning	Impingement of a high-kinetic-energy stream of abrasive on to the surface to be prepared.
activation	Elimination of a passive surface condition. NOTE: Not to be confused with ‘conditioning’.
addition agent; additive	A material added, usually in small quantities, to a solution to modify its characteristics or the properties of the metallic deposit obtained from the solution.
adhesion	The strength of the bond between a coating and its substrate, expressed as the force per unit area required to separate them.
alkaline blackening; black finishing:	Production of a black oxide or sulfide coating on steel or copper (copper alloys) by immersion in hot alkaline salt solutions.
alkaline cleaning	Cleaning by a water solution containing alkaline degreasing cleaning components and detergents.
alkaline descaling	The process of descaling a metal by immersion in a hot alkaline solution.
anion	A negatively charged ion.
anode	In electrolysis, the electrode at which negative ions are discharged, positive ions are formed or other oxidizing reactions occur.
anode corrosion	Dissolution of anode metal by the electrochemical action in the electrolytic cell. (The dissolution of the anode by chemical action of the electrolyte without current is generally not called corrosion, but dissolution.)
anode efficiency	Current efficiency of a specified anodic process.
anode film	Solid film formed on the anode during electrolysis. NOTE: The preferred term is ‘diffuser layer’.
anode polarization	<i>See</i> ‘polarization’.
anodic coating:	
anodic oxide coating	A protective, decorative or functional coating formed by conversion of the surface of a metal in an electrolytic oxidation process. <i>See</i> ‘anodizing’.
sacrificial coating	A metallic coating less noble than the basis metal.
anodizing; anodic oxidation	An electrolytic oxidation process in which the surface layer of a metal, such as aluminium, magnesium or zinc, is converted to a coating, usually an oxide, having protective, decorative or functional properties.
anodized aluminium	Aluminium with an anodic oxidation coating, produced by an electrolytic oxidation process, in which the surface of the aluminium is converted to a coating, generally an oxide, having protective, decorative or functional properties.

anolyte	In a divided cell, the portion of electrolyte on the anode side of the diaphragm and the electrolytes surrounding the anode in a single cell.
autocatalytic plating	Deposition of a metallic coating by a controlled chemical reduction that is catalyzed by the metal or alloy being deposited.
auxiliary anode	A supplementary anode employed during electrodeposition to achieve a desired thickness distribution of the deposit.
auxiliary cathode	See ‘thief’.
average coating thickness	The mean value of not fewer than five local thickness measurements that are evenly distributed over the significant surface of a single piece, or the value obtained using the gravimetric method of thickness determination.
baking	Heating to low temperatures before or after electroplating or autocatalytic plating process steps to reduce residual stresses or to remove gases causing embrittlement effects.
barrel electroplating	A barrel process, (see barrel processing) electrodeposits which are applied to articles in bulk: in contrast to vat plating, see ‘vat plating’.
barrel processing	Mechanical, chemical or electrolytic treatment of articles in bulk in a rotating container. Examples are barrel burnishing, barrel polishing, barrel cleaning, barrel electroplating.
base metal (basis)	Metal in the form of sheet, coil, cut lengths, strip, extruded sections, forgings or castings prior to surface treatment.
basis material; basis metal	Material upon which coatings are deposited or formed, (see ‘substrate’).
batch average thickness	The average thickness of the coating on all the items of an inspection batch as determined on a representative sample
bead blasting	See ‘blasting: bead blasting’.
bipolar electrode	A conductor immersed in the electrolyte between the anode and the cathode but not connected to the power supply. The part of the conductor nearest the anode acts as a cathode and that nearest the cathode acts as an anode.
blackening: black finishing; black oxide treatment	The production of a black finish, see ‘alkaline blackening’.
blasting:	A process in which solid metallic, mineral or vegetable particles are projected at high velocity against the work piece for the purpose of cleaning, abrading or peening its surface. If the process is principally used for imparting hardness or compressive stress, it is normally termed peening (see ‘shot peening’).
abrasive blasting	General term for blasting using abrasive particles.
bead blasting	A process whereby small spherical glass or ceramic beads are propelled against a metallic surface. It is carried out in either wet or dry state.
cut wire blasting	Blasting with short cut lengths of wire (ferrous and non-ferrous).
grit blasting	Abrasive blasting with small, irregularly shaped pieces of steel or cast iron.
mineral sand blasting	Abrasive blasting with sand or related hard material of similar particle size (for example pumice, silicon carbide or aluminium oxide).

shot blasting	A process whereby hard, small, spherical objects (such as metal shot) are propelled against a metallic surface. NOTE: To be distinguished from 'shot peening'.
wet blasting	Blasting with a liquid medium or slurry containing abrasive to clean delicate parts of close dimensional tolerances and to enhance the fatigue resistance of hardened parts.
blast-cleaning abrasive	Solid material intended to be used for abrasive blast-cleaning.
blister	A dome shaped defect in a coating arising from loss of adhesion between coating and substrate.
blueing	The formation of a very thin blue oxide film on steel either by heating in air or by immersion in concentrated oxidizing solutions.
bright anodized aluminium	Anodized aluminium with a soft bright to a high specular reflectance as a primary characteristic.
bright dipping	Immersion in a solution to produce a bright surface on a metal.
bright electroplating	A process that produces an electrodeposit having a high degree of specular reflectivity in the as-plated condition.
bright electroplating range	The range of current densities within which an electroplating solution produces a bright deposit under a given set of operating conditions.
bright finishing	A finish with a uniform non-directional smooth surface of high reflectivity.
brightener	An addition agent in an electroplating or autocatalytic solution that improves the brightness of the deposit.
bronzing	The application of a chemical (immersion) finish to copper and copper alloys or, alternatively, to copper and brass electroplated metals, to alter the colour of the surface.
brush electroplating	A method of electrodeposition in which the electrolyte is contained in a pad or brush in contact with the anode. The pad or brush is applied to the part to be processed, which is given opposite polarity.
brush polishing (electrolytic)	A particular method of electropolishing (see 'electropolishing') in which the electrolyte is contained in a pad or brush in contact with the cathode. The pad or brush is applied to the part to be processed, which is given opposite polarity.
buffer	A substance that, when contained in a solution, opposes changes in pH. Each buffer has a characteristic range of pH over which it is effective.
buffing	See 'mopping'.
burnishing	The smoothing of surfaces by rubbing under pressure essentially without removal of the surface layer.
burn-off	The unintentional removal of an autocatalytic deposit from a non-conducting substrate during subsequent electroplating operations, owing to the application of excess current or a poor contact area.
burnt deposit	A rough unsatisfactory deposit produced by an excessive current density.
busbar	A rigid conductor for carrying current, for example to the anode and cathode bars.

cathode	In electrolysis, the electrode at which positive ions are discharged, negative ions are formed or other reducing reactions are formed or other reducing reactions, such as the deposition of metal, occur.
cathode efficiency	Current efficiency of a specified process.
cathode polarization	See ‘polarization’.
cathodic protection	Method of reducing corrosion rate by making the work piece cathodic, either by applying an external voltage or by making an electrical connection with a sacrificial anode. See ‘sacrificial protection’.
catholyte	In a divided cell, the portion of electrolyte on the cathode side of the diaphragm and the electrolyte surrounding the cathode in a cell.
cation	A positively charged ion.
chelate compound	A compound in which the metal atom is not readily disassociated, by virtue of its being covalently bonded within an organic chain structure.
chelating agent	An organic compound capable of forming a compound with a metal ion.
chemical conversion treatment	Modification to a metal surface by chemical or electrochemical treatment with chromate ions, chromate/phosphate ions, phosphate ions or other proven methods, without the use of an applied electric current.
chemical milling chemical contouring	The shaping of a work piece by immersion in a suitable etchant. Those parts of the work piece not to be milled are protected by a resist.
chemical plating	Deposition of a metal coating by chemical, non-electrolytic methods, e.g. contact plating, immersion plating, autocatalytic plating, non-autocatalytic plating.
chemical polishing	Immersion in a solution to produce improved surface smoothness of a metal.
chromate conversion coating	The surface coating obtained by chromating.
chromate coatings, non-rinsed	Chromate coatings that are dried immediately after the chromating step without receiving a water rinse.
chromate coatings, rinsed,	Chromate coatings that are rinsed in water prior to drying.
cleaned surface	Surface from which the contaminants have been removed to a specified level.
cleaning:	The removal of all foreign materials from a surface.
acid cleaning	Cleaning by means of acid solutions.
alkaline cleaning	Cleaning by means of alkaline solutions.
anodic (reverse) cleaning	Electrolytic cleaning in which the work piece to be cleaned is an anode.
cathodic (direct) cleaning	Electrolytic cleaning in which the work piece to be cleaned is a cathode.
diphase cleaning	Cleaning by means of a liquid system that consists of an organic solvent layer and an aqueous layer. Cleaning is effective both by solvent and emulsifying action.
direct cleaning	See ‘cathodic (direct) cleaning’.

electrolytic cleaning	Cleaning in which an electric current is passed through the solution, the work piece to be cleaned being one of the electrodes.
emulsion cleaning	Cleaning by means of an emulsified liquid system that consists of an organic solvent, a water phase and emulsifying agents.
immersion cleaning	See 'soak cleaning'.
reverse cleaning	See 'anodic (reverse) cleaning'.
soak cleaning	Cleaning by immersion without the use of electric current, usually in alkaline solution.
solvent degreasing	Cleaning by means of organic solvents.
spray cleaning	Cleaning by means of spraying with a cleaning solution.
ultrasonic cleaning	Soak cleaning aided by ultrasonic vibration.
vapour degreasing	Degreasing by solvent vapours condensed on the work pieces being cleaned.
clear anodized aluminium	Aluminium with a substantially colourless, translucent anodic oxidation coating. Clear anodized aluminium is also referred to as natural anodized aluminium; it can have either a matt finish or a bright finish.
coated specimen	A test piece made from the same basis metal as the coated item and which has been processed at the same time as the coated item.
coating mass	Mass coating per unit surface area of substrate, expressed in grams per square metre.
colour anodized aluminium	Anodized aluminium coloured either during anodising or by subsequent processing.
colouring	A chemical immersion process producing decorative coloured finishes excluding black finishes on steel and colours obtained by the use of organic dye-stuffs.
colouring off	Light final mopping.
complex ion	See 'complexing agent (b)'.
complexing agent	<p>(a) A compound that will combine with metallic ions to form complex ions.</p> <p>(b) A compound of two single salts which crystallize together in a simple molecular ratio. In aqueous solutions a complex salt is dissociated into ions (complex ions) giving reactions which are quite distinct from those of the component single ions.</p> <p>Example of a complex salt: potassium silver cyanide $[\text{KAg}(\text{CN})_2]$.</p> <p>Example of a complex ion: Cuprocyanide ion $[\text{Cu}(\text{CN})_3]^{2-}$.</p>
composite coating (electroplating)	A coating consisting of a metal containing codeposited metallic or non-metallic particles.
composite coating (mechanical plating)	A mixture of powdered metals to meet a specified coating composition.
conditioning	Precoating steps comprising the conversion of a surface to a suitable state for successful treatment in succeeding steps.
conducting salt	A salt added to an electrolyte to increase its electrical conductivity.

contact mark	Discontinuity in a coating at the point where contact existed between the part and the rack during coating.
contact plating	The deposition by galvanic action of a metal coating upon a metal substrate by immersing the latter in contact with another metal in a solution containing a compound of the metal to be deposited.
contaminated surface	Surface on which material deleterious to the performance of a protective coating system is present.
conversion treatment	Chemical or electrochemical process of producing a coating (conversion coating) consisting of a compound of the surface metal. Conversion coatings are, for example: chromate films on zinc and cadmium; oxide and phosphate coatings on steel.
covering power	The ability of an electroplating solution, under a given set of conditions, to deposit metal initially over the entire surface of the cathode.
crack	Narrow lateral separation of random dimensions and orientation in a surface coating.
crazing	An unintentional network of fine cracks.
critical current density	Current density above or below which different and sometimes undesirable reactions occur.
current density	Current intensity per unit surface area of the electrode, usually expressed in amperes per square decimetre (A/dm ²).
current efficiency	The proportion, usually expressed as a percentage, of the current that is effective in carrying out a given process in accordance with Faraday's law.
cylindrical particles	Sharp-edge particles used in mechanical finishing operations, having a diameter-to-length ratio of 1:1, cut so that their faces are approximately at right angles to their centre-line.
deburring	The removal of burrs or sharp edges, by mechanical, chemical or electrochemical means.
de-gassing	A heating process used to expel entrapped gases prior to, or after, coating.
deionization	The removal of ions from a solution by ion exchange.
depolarization	A decrease in the polarization of an electrode.
deposition range	See 'electroplating range'.
detergent	A surface active agent that possesses the ability to assist in cleaning soiled surfaces.
diaphragm	A porous separator dividing anode and cathode compartments of an electroplating tank from each or from an intermediate compartment, while allowing current to flow.
diffusion layer	In electrolytic processes, the thin layer of the solution, which is in contact with an electrode and differs in its concentration from that in the bulk of the solution.
diffusion treatment	<ul style="list-style-type: none"> (a) Process of producing a surface layer (diffusion layer) by diffusion of another metal or non-metal into the surface of the substrate. (b) In electroplating, heat treatment applied to a work piece to achieve alloying or intermetallic compound formation between coating and basis metal or between two of more coatings.

dirt (soil)	Any organic or inorganic contaminant on the metal surface which will interfere with a subsequent metal finishing operation (process) if not removed. Dirt or soil may be any one or a number of materials, such as shop dirt, abrasive grains, metal dust and chips from metal surface, and free graphite carbon smut.
divided cell	A cell containing a diaphragm or other means for physically separating the anolyte from the catholyte.
double salt	Two salts that crystallize together in stoichiometric proportions but give the reactions of the ions of the constituent single salts in aqueous solution, for example Rochelle salt.
drag-in	The liquid carried into the bath by the objects introduced therein.
drag-out	The liquid carried out of a bath by the objects removed therefrom.
dull finish	A finish virtually lacking both diffuse and specular reflectance.
dummy (dummy cathode)	A cathode used for removal of electrochemical or decomposition of impurities in electroplating solutions.
dyed anodized aluminium	Aluminium with anodic oxidation coating coloured by absorption of dyestuffs or pigments into the pore structure.
dyeing (in anodizing)	Imparting a colour by immersion of an unsealed coating in solutions of dye-stuffs.
electrochemical machining (ECM) (electro chemical milling)	The shaping of a metal work piece (anode) by passing a direct electric current through an electrolyte in the gap between it and a suitably shaped tool (cathode) which concentrates the current in those areas where preferential metal removal is desired.
electrode	A term denoting anode or cathode.
electrodeposition	The process of depositing a substance upon an electrode by electrolysis. Electrodeposition includes electroplating, electroforming, electro-refining and electrowinning, electrocoating and electropainting.
electroforming	The production or reproduction of articles by electrodeposition upon a mandrel which is subsequently separated from the deposit.
electrogalvanized coating	A coating consisting of zinc produced by electrogalvanizing.
electrogalvanized strip	Steel strip with a coating consisting essentially of metallic zinc, produced by continuously passing steel strip through an electroplating bath containing a solution of an appropriate zinc salt.
electrogalvanizer	A person, persons or organization ('the manufacturer') responsible for the coating of a product with metallic zinc by means of the electrogalvanizing process.
electrogalvanizing	A process comprising pre-treatment and electroplating baths in which an adherent metallic zinc coating of controllable thickness is applied to steel products.
electrolyte	Any conducting solution used for electrolytic processes.
electrolytic colouring	An electrolytic process of colouring anodic films in metal salt solutions.
electrolytic descaling	The process of descaling a metal by making it an electrode in a bath containing a suitable electrolyte.

electrolytically coloured anodized aluminium	Aluminium with an anodic oxidation coating that has been coloured by the electrolytic deposition of a metal oxide in the pore structure.
electroplating	The electrodeposition of an adherent metallic coating upon an electrode for the purpose of securing a surface with properties or dimensions different from those of the basis metal.
electroplating range	The current density range over which a satisfactory electrodeposit can be obtained.
electropolishing	The smoothing and brightening of a metal surface by making it anodic in an appropriate solution.
emulsifying agent; emulsifer	A substance used to produce a stable emulsion.
etch	<ul style="list-style-type: none"> (a) To remove material from a surface by chemical action (e.g. as in chemical milling). (b) To roughen the surface of a material by selective dissolution. (c) Colloquial for <i>etchant</i>.
etchant	Solution used for etching, see 'etch' (a) and (b).
finish	<ul style="list-style-type: none"> (a) The appearance of the coating or basis metal. (b) The treatment leading to this appearance.
finish state	The condition of an item after coating and any subsequent treatment.
flash; flash plate	A very thin electrodeposit produced in a short time. This term should only be used for a final coating; for intermediate coatings of the same nature, use <i>strike</i> .
flocculate	<ul style="list-style-type: none"> (a) To induce the agglomeration of particles in suspension. (b) To aggregate into agglomerates sufficiently large to precipitate.
flow-melting, fusing, flow-brightening, reflowing	A process by which a coating is melted in order to impart desirable properties such as brightness or improved solderability.
galvanizer	A person, persons or organization responsible for the coating of the article with molten zinc.
galvanizing	See electrogalvanizing and hot-dip galvanizing.
gassing	Visible evolution of gases from electrodes during electrolysis.
gold or gold alloy coating	An electrodeposited coating of gold or gold alloy, having a gold content of not lower than 58.5% (m/m).
grinding	The removal of material by means of abrasive contained in, or bonded to, a rigid or flexible holder. A ground surface is characterized as having a coarse grained line pattern. Grinding is often the initial step in polishing operations.
grit	Particles used in the mechanical finishing operations that are predominantly angular, that have fractured faces and sharp edges and that are less than half-round in shape.
hand tool cleaning	Method of preparing steel substrates by use of hand tools, without power assistance.

high pressure cleaning	Cleaning by high pressure (34 MPa – 70 MPa) hot or cold water that may contain appropriate cleaning components.
holiday	A localized coating defect, characterized by a very low or zero coating thickness.
hollow section	A section produced by roll forming carbon or low alloy steel from strip.
hot-dip coating	A coating applied by the immersion of metal product in a bath of molten-coating metal.
hot-dip galvanized coating	A coating applied to steel by hot-dip immersion in molten zinc of at least 98% purity; the resultant coating consists of an outermost layer of zinc over zinc/iron alloys that are metallurgically bonded to the steel substrate.
hot-dip galvanizing	A process comprising pre-treatment, and molten zinc baths in which steel products are dipped so as to form adherent zinc and zinc-iron alloy coatings.
hull cell	A trapezoidal box of non-conducting material with electrodes arranged to permit observation of cathodic or anodic effects over a wide range of current densities.
hydrogen embrittlement	A particular type of embrittlement of a metal or alloy caused by absorption of atomic hydrogen, for example during a pickling, cathodic cleaning or electroplating process. It manifests itself by fracture or a reduction of ductility.
hydrogen embrittlement relief	Treatment given to metals after surface treatment to reduce or eliminate embrittlement due to absorption of hydrogen. In electroplating, this treatment almost exclusively consists in baking.
hydrothermal sealing	See sealing of anodic oxide coating.
immersion deposit	A metallic deposit produced by a displacement reaction in which one metal displaces another from solution, for example: $\text{Fe} + \text{Cu}^{2+} \rightarrow \text{Cu} + \text{Fe}^{2+}$
immersion plating	The production of an immersion deposit. See ‘immersion deposit’.
impregnation of anodized aluminium	A treatment carried out after anodising in order to plug the pores of anodic oxidation coating, but not involving hydrothermal sealing.
inert anode	See ‘insoluble anode’.
inhibitor	A substance added to a solution to inhibit or prevent a chemical or electrochemical reaction.
in-line hot-dip galvanizing	An in-line process using specialized equipment comprising pre-treatment and molten zinc baths through which steel products are continuously passed so as to form an adherent zinc and zinc-iron alloy coating. During the continuous in-line galvanizing process a very uniform, smooth finish is achieved by removing the excess coating by mechanical or other means.
insoluble anode	An anode which does not contribute metal ions to the electrolyte during electrolysis.
inspection batch	A collection of items in the finished state from which a sample is randomly drawn and inspected to determine conformance with the acceptance criteria. It may differ from a collection of product items designated as a batch for other purposes, such as production, shipment and storage.

integral colour anodized aluminium	Aluminium that has been anodized using an appropriate (usually organic acid-based) electrolyte which produces a coloured coating during the anodising process itself.
integral colour anodizing	Colouring the surface of certain aluminium alloys using appropriate, usually organic, acid-based electrolytes, during the anodising process itself.
interrupted electroplating; pulse plating	A method of electroplating in which the current is frequently interrupted or periodically decreased.
ion exchange	A reversible process by which ions are interchanged between a solid and a liquid without substantial changes of the solid.
jig	See 'rack'.
lapping	An abrading process for refining the surface finish or geometric accuracy of flat, cylindrical or spherical surfaces by using appropriate conforming material, contained in the counter surface or in a grease or liquid, or loose.
levelling	The ability of an electroplating solution to produce a coating with a surface smoother than that of the substrate.
linishing	Directional grinding of flat surfaces by means of an abrasive bonded to an endless flexible belt.
local thickness	The mean of not fewer than three thickness measurements, within a small area (10 mm diameter, or less) of the significant surface of a single coated piece or reference area.
mandrel	(a) A form used as a cathode in electroforming; a mould or matrix. (b) Support used in bending tests.
matrix	See 'mandrel'.
matt anodized aluminium	Anodized aluminium with a low specular reflectance.
matt finish	A uniform finish of a fine texture virtually lacking specular reflectivity.
measuring area	The area of significant surface over which a single measurement is made. The measuring area for this method is the area enclosed by the sealing ring of the cell.
mechanical plating; peen plating	The application of a metallic layer by impacting spherical objects (for example glass beads) against the surface in the presence of powdered coating metal and appropriate chemicals.
metal distribution ratio	The ratio of the thickness of deposited metal upon two specified areas of a cathode. See 'throwing power'.
microcracked chromium coating	An electrodeposited coating of chromium with an intentional microscopic cracking pattern.
microdiscontinuity	A microcrack or a micropore.
microporous chromium coating	An electrodeposited coating of chromium with an intentional microscopic porosity.
microthrowing power	The ability of an electroplating solution under a specific set of conditions to deposit metal in pores or scratches.
minimum local thickness	The lowest value of the local thickness found on the significant surface of a single article.

modulated current plating:	A method of electroplating in which the cathodic current density is changed periodically. The cycles usually do not exceed a few minutes, and may be much less.
mopping	The 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 a grease stick. A mopped (buffed) surface is characterized as semi-bright to mirror-bright without pronounced line patterns on the surface.
multilayer deposit	A coating consisting of two or more layers of metal deposited successively. These layers may consist of the same metal with different characteristics or of different metals.
multilayer gold or gold alloy coating	A gold or gold alloy coating consisting of more than two continuous layers of differing gold content.
neutral cleaning	Cleaning by a water solution containing neutral pH cleaning components and detergents.
noble metal	A metal with a high positive electrode potential as compared with that of the normal hydrogen electrode. A metal is called nobler than another if it can be displaced from its solution by the latter.
nodule	A rounded projection formed on a cathode during electrodeposition. See 'tree'.
non-autocatalytic plating	Deposition of a metallic coating by a controlled chemical reduction that is not catalyzed by the metal or alloy being deposited.
nucleation	A preplating step in which a catalytic material is adsorbed onto the surface of the substrate to act as sites for the initial stages of deposition.
oil, grease and related contamination	Organic contamination, such as oil, grease, wax, fat, cutting oils, silicones and perspiration marks, e.g. finger prints, that is not wetted by water and which adversely affects coating adhesion.
open section	A section produced by cold forming carbon or low alloy steel sheet, strip, plate or bar, e.g. angles, channels and flats.
orange peel	A finish resembling the dimpled appearance of an orange peel.
organic coating	A coating of drying or non-drying oil, grease, lacquer, varnish, paint or any organic material.
oxidation	A reaction in which electrons are removed from a reactant. Sometimes, more specifically, the combination of a reactant with oxygen.
oxidizing agent	A compound that causes oxidation, thereby itself becoming reduced.
passivating	Imparting passivity to a metal surface.
passivity	The condition of a metal surface that retards its normal reaction in a specified environment and is associated with the assumption of a potential more noble than normal.
peeling	The detachment or partial detachment of a coating from a substrate or undercoat.
peening	See 'shot peening'.
peen plating	See 'mechanical plating'.

periodic reverse electroplating	A method of electroplating in which the current is reversed periodically.
phosphating:	
phosphating process (accelerated)	A process which uses a metal phosphate/phosphoric acid type solution containing additives such as water-soluble oxidizing agents, e.g. nitrates, nitrites, chlorates and hydrogen peroxide, to accelerate the coating formation.
phosphating process (unaccelerated)	A process which uses a metal phosphate/phosphoric acid type solution without the additives which normally accelerate coating formation.
pickling	Removal of oxides or other compounds from the basis metal surface by chemical or electrochemical action.
pit	A small depression or cavity produced in a coating during the coating process or by corrosion. A small depression or cavity produced on a metal surface by corrosion.
plating range	See 'electroplating range'.
polarization	<p>The change in the potential of an electrode during electrolysis, such that the potential of an anode always becomes more noble and that of a cathode less noble than their respective static potentials (at zero current).</p> <p>Equal to the difference between the static and the dynamic potentials, usually expressed in millivolts.</p>
polishing	The final stages of smoothing a metal surface by the action of abrasive particles. These particles are most commonly attached by adhesive to the surface of wheels or endless belts.
pore (in a coating)	An essentially circular discontinuity in the surface extending through to the underlying coating or to the basis metal.
powder-coated metal	Pretreated metal finished with a powder coating.
powder coating	Powder coatings consist of pigments and reinforcing fillers combined with resins such as epoxy and polyester. They are applied to suitably prepared ferrous and non-ferrous surfaces, by electrostatic spraying of the powder.
power supply	<p>(a) A device for providing direct current to electroplating processes.</p> <p>(b) A device for providing electrical power for powder coating processes.</p>
power tool cleaning	Method of preparing steel substrates by the use of power-assisted tools but excluding blast cleaning.
primary current distribution	The distribution of the current over the surface of an electrode which would be expected from geometrical considerations alone but also taking into account possible potential differences within the electrode, such as may arise in thin wires or thin metal coatings on non-conducting substrates.
pre-galvanized strip	Strip with a coating consisting of zinc-iron alloys covered by zinc, produced by continuously passing steel strip through a bath of molten zinc and mechanically removing the excess zinc.
pretreated metal	Basis metal to which an appropriate chemical conversion treatment has been applied.
pretreated substrate	A substrate to which an appropriate chemical conversion has been applied.

rack; plating rack; jig	A frame for suspending and carrying current to articles during electroplating, powder coating and related operations, or a frame for suspending articles prior to coating.
rack plating	An electrodeposition process in which articles to be coated are mounted on racks or other fixtures during the process.
rectifier	A device that converts alternating current into direct current.
reference area	The area within a specified number of single measurements are required to be made.
relieving	The removal of material from selected portions of a coloured metal surface by mechanical means to achieve a gradually changing effect.
resist	<p>(a) A material applied to a part of an electrode or plating rack to render the surface non-conductive.</p> <p>(b) A material applied to a part of the surface of an article to prevent reaction of metal in that area during chemical or electrochemical processes.</p>
ripple (d.c.)	Regular modulations in the d.c. output created by the characteristics of the source of supply.
robber	See 'thief'.
sacrificial protection	The form of cathodic protection whereby a metal is protected by corrosion of a more anodic (less noble) metal with which it is in electrical contact.
satin finish	<p>(a) A lustrous finish having a fine directional texture (produced mechanically).</p> <p>(b) A fine matt finish, which is lustrous without directional texture (produced by a variety of methods).</p>
scale	An adherent oxide layer formed on the surface of metals during heat treatment or hot working.
sealing of anodic oxide coating	A hydrothermal or impregnation treatment carried out after anodising to reduce porosity and absorptivity of the anodic oxidation coating.
sealing of phosphate surface	The application of an organic coating to a phosphated surface.
sealing rinse	Use of a chromium based or chromium free chemistry to seal a phosphate coating.
sensitization	The adsorption of a reducing agent onto the surface of the substrate.
shield	<p>(a) A non-conductive barrier positioned so as to alter the current distribution on an anode or cathode.</p> <p>(b) To alter the current distribution on an anode or cathode by the interposition of a non-conductor.</p>
shot	Particles used in mechanical finishing operations that are predominantly round, that have a length of less than twice the maximum particle width and that do not have edges, broken faces or other sharp surface defects.
shot peening	A process whereby hard, small spherical objects (such as metallic shot) are propelled against a metallic surface for the purpose of introducing compressive stresses into that surface, hardening it or obtaining decorative effects.

significant surface	That part of the surface of an item which is required to be covered by the coating and which is essential to its appearance and serviceability as agreed between the purchaser and the metal finisher.
smut	A reaction product sometimes left on the surface of a metal after a pickling or an etching operation.
softening of water	Removal of hardness in water, for example by cation exchange.
solvent cleaning	Cleaning by solvent, assisted by mechanical displacement such as wiping, agitation and spraying.
solvent emulsion	Cleaning by emulsification and solution.
spalling	The chipping or fragmenting of a surface coating that occurs without obvious external causes, for example by differential thermal expansion or contraction.
spotting out	The delayed appearance of spots and blemishes on electroplated or finished surfaces.
staining of phosphate coating	The application of a coloured solution or a dye to impregnate a phosphate surface.
still plating	<i>See</i> 'vat plating'.
stopping off	The application of a resist (<i>see</i> 'resist') to any part of an electrode or rack.
stoving	<i>See</i> 'baking'.
stray current	Current through paths other than the intended circuit, such as through heating coils or the tank.
stress relieve	A heat treatment used for the reduction of residual stresses in electrodeposited coatings and/or in the basis metal.
strike	<ul style="list-style-type: none"> (a) A thin film of electrodeposited metal which facilitates the deposition of subsequent coatings. (b) A solution specially formulated to obtain this film. (c) An electrodeposition process of short duration applied to the basis metal or undercoat to assist the adhesion of subsequent electrodeposits and to limit metallic contamination of the electrolyte and/or subsequent electrodeposits.
strip	<ul style="list-style-type: none"> (a) A process or solution used for the removal of a coating from a basis metal or an undercoat. (b) To remove a coating from the basis metal or undercoat.
substrate	Material upon which a coating is directly deposited. For a single or first coating the substrate is identical with the basis material, (<i>see</i> 'basis material') for a subsequent coating the intermediate coating is the substrate.
superimposed current electroplating	A method of electroplating in which the current is modulated periodically by superimposing surges, ripples, pulses of alternating current on the d.c. electroplating current.
supplier	A person, persons or organization responsible for the supply of the coated product.
surface	The surface of the item on which the metal finisher is to work.

surface active agent	A substance that affects markedly the interfacial or surface tension of solutions even when present in very low concentrations. (See ‘detergent’ and ‘wetting agent’.)
surface tension	That property, due to molecular forces, that exists in the surface film of all liquids and tends to prevent the liquid from spreading or satisfactorily wetting.
tank voltage	The potential difference measured between the anode and cathode of an electroplating bath or electrolytic cell during electrolysis.
tarnish; tarnishing	(a) The dulling, staining, or discolouration of metals due to slight corrosion. (b) The film so formed.
thief	An auxiliary cathode so placed as to divert to itself some current from portions of the work which otherwise receive too high a current density.
throwing power; macrothrowing power	The ability of an electroplating solution to approach uniformity of the coating thickness over the entire surface of the work piece including its recesses. The term may also be used for anodic processes for which the definition is analogous.
transference; transport; migration	The movement of ions through the electrolyte associated with the passage of the electric current.
transference number; transport number	The proportion of the total current carried by the ions of a given kind.
trees	Dendrites, branches or irregular projections formed on a cathode during electrodeposition, especially at edges and other high current density areas.
tripoli	Friable and dust-like diatomaceous silica used as an abrasive.
tumbling	Bulk processing in barrels, in either the presence or absence of abrasives or burnishing shot, for the purpose of improving the surface finish.
undercoat	A preliminary coating applied to alter the surface characteristics of the basis metal.
undercoating	A metallic coating layer between the basis metal or substrate and the topmost metallic coating. The thickness of an underplating is usually greater than 1 µm, in contrast to a strike or flash, which is thinner.
underplate	A preliminary coating applied to alter the surface characteristics of the basis metal.
vapour degreasing	Cleaning in solvent vapour phase, involving solvent condensation and run-off.
vat plating	The process in which the articles to be electroplated are independently attached to the cathode.
water break	The appearance of a discontinuous film of water on a surface signifying non-uniform wettability usually caused by a surface contamination.
water break test	A test that is indicative of the absence of hydrophobic contaminants. The surface is examined for the presence of a continuous water film that has no breaks, or droplet formations on the surface.
wetting agent	A substance that reduces the surface tension of a liquid, thereby causing it to spread more readily on a solid surface, (see ‘detergent’ and ‘surface active agent’.)

whiskers	Monocrystalline metallic filamentary growths, often microscopical but sometimes reaching lengths of several centimetres, formed, sometimes spontaneously, during storage or service or, more rarely, during electrodeposition.
white glove test	A test where the surface to be tested is wiped with a white glove, cotton swab or lens tissues. The test may be used on dry or wet surfaces.

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