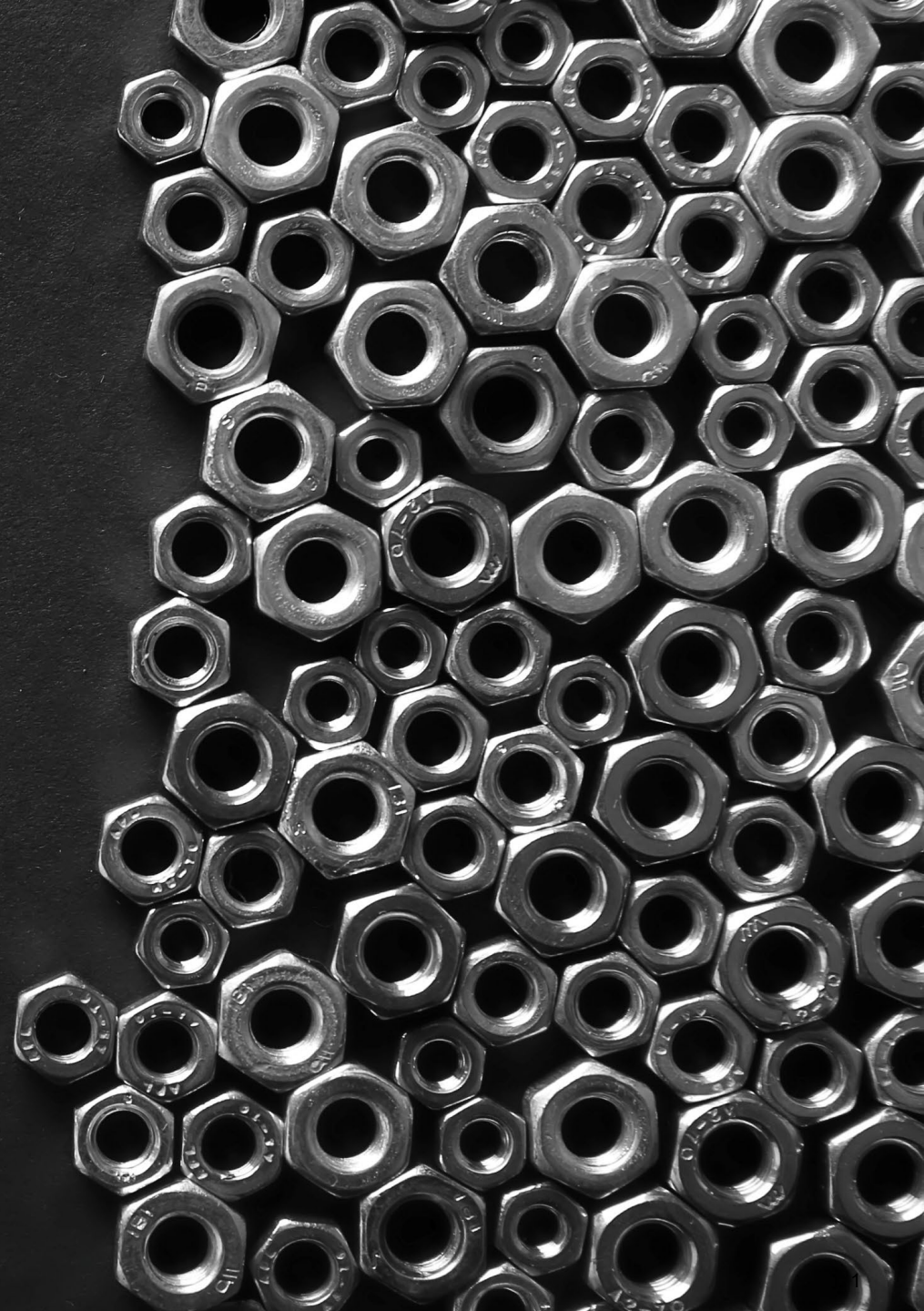
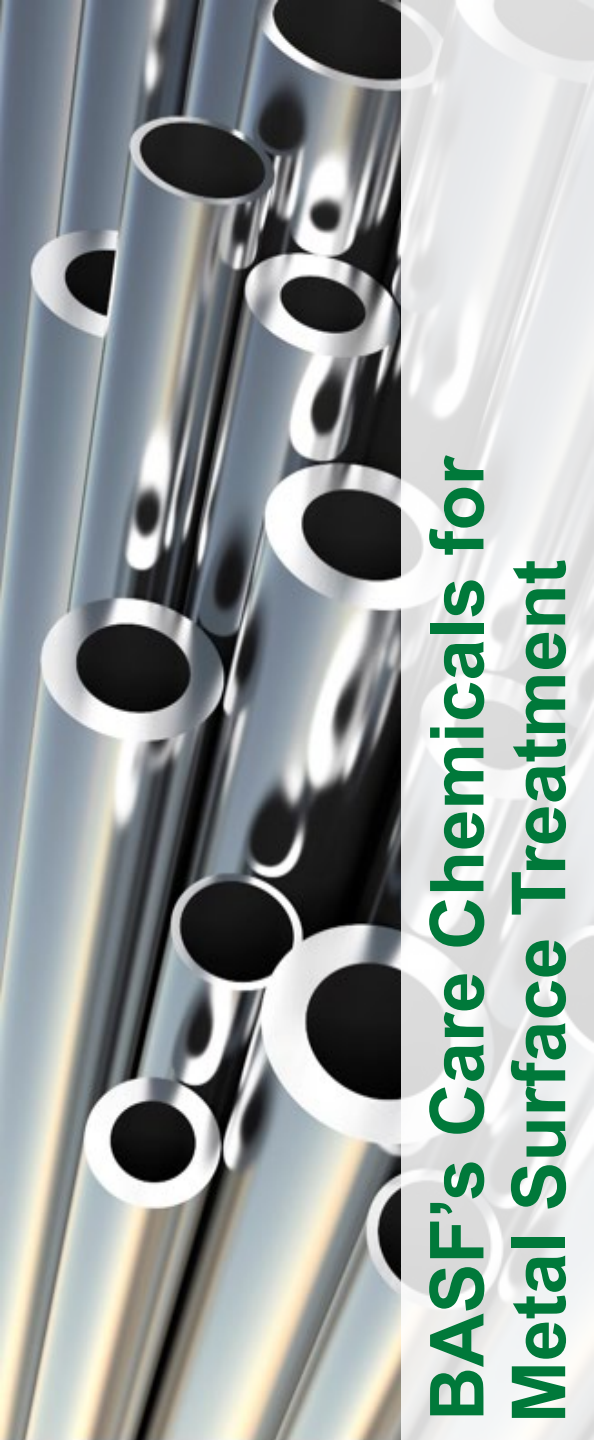




Metal Surface Treatment

by BASF Industrial Formulators Europe





BASF's Care Chemicals for Metal Surface Treatment

BASF supplies a proven range of specialty chemicals for protecting and finishing metal surfaces.

We supply high-performance products for metal surface treatment. They can be employed in a variety of different processes such as electroplating, electroless plating, corrosion protection and post treatment for metal.

We create added value through innovation based on our expertise in the field of organic specialty chemicals and the solutions we provide for specific applications.

The extensive BASF range of chemicals enables sustainable products that fulfill high standards of performance to be formulated.

We help our customers to be more successful ...

... with **expertise, innovation** and **a lasting commitment** to metal surface treatment.

Our know-how in the field of specialty chemicals for metal surface treatment and corrosion protection combined with your experience in developing formulations offer the following benefits:

- High-quality decorative effects can be obtained.
- Surfaces of every shape and size can be protected from corrosion and mechanical damage very effectively.

This provides the basis for the long-term success of you and your customers.

It's because at BASF, we create chemistry.



Chemicals for Electroplating

Performance Chemicals for Metal Surface Treatment

BASF is the leading supplier of performance chemicals used in formulations for metal surface treatment.

Common applications of BASF products are:

- Electroplating with Zn, Sn, Ni, Cu, Cr, Ag, and alloys
- Electroless plating with Cu, Ni, Sn and precious metals
- Specialty products for circuit board manufacturing

Chemicals for surface treatment

The dedicated product lines for metal surface technology are:

Golpanol® grades	Chemicals for galvanic nickel baths, stripper
Lugalvan® grades	Chemicals for galvanic baths: Zinc, tin, copper, and other metals including alloys
Lutron® grades	Chemicals for copper and zinc baths, functional fluids for reflow and hot air leveling in printed circuit board manufacturing, heat-transfer fluids
Lutropur® grades	High-purity Methane sulfonic acid



Chemicals for Electroplating

Applications

Nickel

Nickel is one of the most important plated metals because of its decorative and functional properties. Nickel-plated articles are standardized according to the resistance to corrosion that they are expected to display in service.

These standards specify minimum thicknesses and corrosion resistance according to the severity of service conditions. Other standards also apply to such properties as porosity, adhesion, hardness and abrasion resistance. Our additives ensure that these standard requirements are met.



Zinc

Zinc is an important metal for corrosion protection and has many different applications, some of which are listed below.

- Fittings for mechanical, electrical and automotive engineering applications
- Household equipment, camping and sports goods, supermarket trolleys and shopping baskets, shelving, roof racks, furniture
- Bolts and fasteners, etc.
- Plated wire, tubes and sheet metal
- Office equipment, lighting and electrical goods

Zinc can be plated from different types of electrolyte. Its corrosion resistance can be further increased by chromation/passivation and/or applying an organic coating, which also gives rise to other decorative and functional effects.

We offer a broad portfolio to meet all these requirements.

Chemicals for Electroplating

Applications

Tin

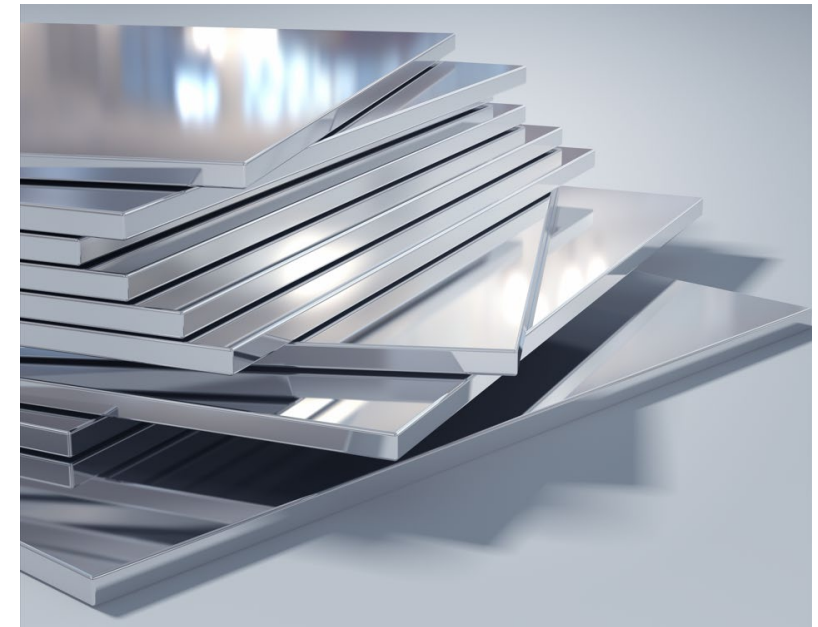
Tin is resistant to many different chemicals, and its toxicity is low in comparison with other metals. This is why it is used for plating tin cans. Another important area of application is in the production of printed circuit boards. Tin is mainly plated from acid solutions. The acids most commonly used are sulfuric acid, fluoboric acid and methanesulfonic acid. Crystal-growth inhibitors are the only additives used in matt tin baths. The additives used for bright tin are similar to those used for zinc.

Copper

Copper and gold were the first metals to be plated by electrodeposition techniques. Copper is mainly plated from alkaline solutions that contain cyanide, or acid solutions that contain sulfuric acid. Electroless plating techniques almost exclusively make use of alkaline solutions. Copper is a soft, ductile metal that is easily polished, and it is a very efficient conductor of heat and electricity. It has many applications in the automotive and electronics industries, and in household goods. Copper is mostly applied as the first layer and then plated over with nickel and chromium. It is only applied as the final layer to printed circuit boards, for ornamental purposes, and in electroforming.

Alloy plating

Plated alloys are usually used to enhance or modify the properties of the respective main metal matrix. Common alloys of Zn comprise co-deposits with Nickel, Iron or Cobalt. Especially Ni increases the corrosion resistance substantially. Zn/Fe Alloys are used to achieve different passivation properties e.g. deep black and thick passivation layers. Tin is mostly alloyed to increase its solderability and adhesion. This can be achieved by co-deposition of Pb, Ag or Bi. For all alloy plating processes, our electroplating additives portfolio can be used. Especially the complexing agents are of high importance to achieve electrolyte stability and consistent alloy composition over a wide range of application parameters.





Chemicals for Electroplating

Product Portfolio

Product	Chemical nature	Function
Nickel Plating		
Golpanol® ALS	Sodium allyl sulfonate	Basic brightener , throwing power, ductility, brightness, 2 – 10 g/l
Golpanol® VS	Sodium vinyl sulfonate	Basic brightener , throwing power, ductility, brightness, 2 – 4 g/l
Pluronic® PE 6400	PO/EO block copolymer	Matting agent , 1 – 5 g/l
Golpanol® BOZ	2-Butyne-1,4-diol	Top brightener , brightness, 100 – 200 mg/l
Golpanol® PA	Propargyl alcohol	Top brightener , brightness, leveling, 10 – 20 mg/l
Golpanol® HD	3-Hexyne-2,5-diol	Brightener , brightness, semibright nickel, 100 – 300 mg/l
Golpanol® MBS Granules N*	Sodium nitrobenzene sulfonate	Oxidation agent/Stripper , 10 – 100 g/l

Chemicals for Electroplating

Product Portfolio

Product	Chemical nature	Function
Zinc Plating – alkaline		
Lugalvan® G 35	Low-molecular polyethylene imine	Basic brightener , throwing power, 0.1 – 5 g/l
Lugalvan® G 15000	High-molecular polyethylene imine	Basic brightener , throwing power, 0.1 – 5 g/l
Lugalvan® IZE	Addition product of imidazole and epichlorohydrin	Basic brightener , levelling, throwing power, 0.5 – 5 g/l
Lutron® PVI	Quaternary polyvinylimidazolium salt in water	Basic brightener , improves adhesion, 0.1 – 2 g/l
Lugalvan® P	Polymer of a quaternary ammonium salt in water	Basic brightener , metal distribution 0.5 – 5 g/l
Lugalvan® BPC 48	Benzylpyridinium-3-carboxylate	Top brightener grain refining, 0.3 – 3 g/l
Disponil® ANA	4-Methoxybenzaldehyde (p-anisaldehyde)	Top brightener grain refining, 0.1 – 1 g/l
Lutron® Q 75	N,N,N',N'-tetrakis-(2-hydroxypropyl)-ethylenediamine	Complexing agent , alloy plating, 10 – 100 g/l

Chemicals for Electroplating

Product Portfolio

Product	Chemical nature	Function
Zinc Plating – acidic		
Lugalvan® HS 1000	Thiodiglycol ethoxylate	Basic brightener for acidic zinc, reduces burnings, brightness, ductility, 0.1 – 5 g/l
Lugalvan® AZP	Fatty alcohol ether sulfate, sodium salt	Basic brightener , for acidic zinc, solubilizer, brightness, 8 – 12 g/l
Lugalvan® BNO 12	β-Naphthol ethoxylate	Basic brightener , solubilizer, throwing power, ductility, 2 – 6 g/l
Tamol® NN 9401	Naphthalinesulfonic acid polycondensate, sodium salt, low inorganic salt content	Dispersing agents (improve ductility)
Tamol® NN 8906	Naphthalinesulfonic acid polycondensate, sodium salt	Dispersing agents (improve ductility)
Lutensol® ON 110	C10-Oxoalcohol + 11 EO	Wetting agent, solubilizer
Lutensol® TO range	C13-Oxoalkohol ethoxylated	Wetting agent, solubilizer
Lutensit® TC-CS 40	Alkylarylsulfonate, in water	Hydrotrope, solubilizer

Chemicals for Electroplating

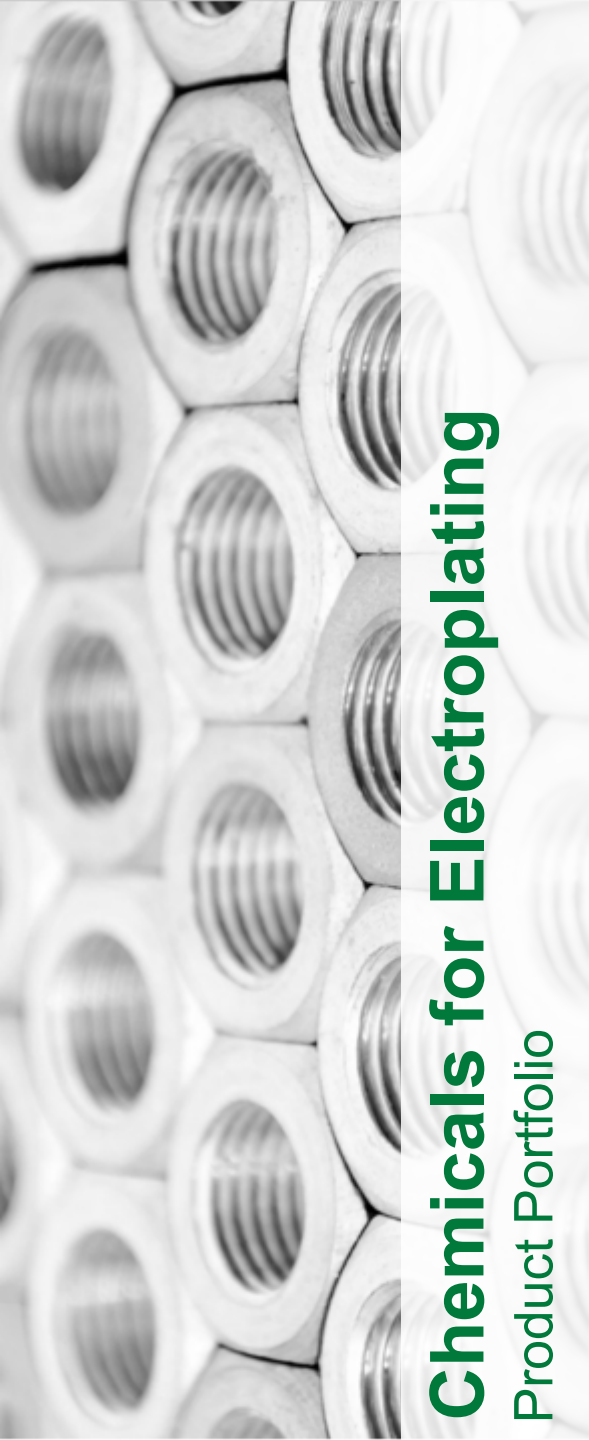
Product Portfolio

Product	Chemical nature	Function
Tin Plating		
Lugalvan® BNO 12	β-Naphthol ethoxylate	Basic brightener , solubilizer, throwing power, ductility, 2 – 6 g/l
Lutron® HF 1	Modified polyglycol ether	Basic brightener , improves brightness and throwing power, 0.1 – 5 g/l
Lutron® KS 1	Modified polyglycol ether	Basic brightener , improves brightness and throwing power, 0.1 – 5 g/l
Pluriol® E range (200-9000)	Polyethylene glycol	Basic brightener , improves brightness and throwing power, 0 – 3 g/l
Texapon® EHS	Ethylhexanol ethoxylate	Basic brightener , wetting, raises cloud point, 2 – 6 g/l
Lugalvan® BPC 48	Benzylpyridinium-3-carboxylate	Top brightener grain refining, 0.3 – 3 g/l
Lugalvan® AZP	Fatty alcohol ether sulfate, sodium salt	Basic brightener , solubilizer, brightness 8 – 12 g/l
Lutropur® MSA / Lutropur® MSA 100 / Lutropur® MSA-XP	Methanesulfonic acid	Base component for electrolytes and metal surface treatment, 80-600 g/l

Chemicals for Electroplating

Product Portfolio

Product	Chemical nature	Function
Copper Plating		
Lutron® HF 1	Modified polyglycol ether	Brightener for copper, 0.1 – 5 g/l
Lutron® KS 1	Modified polyglycol ether	Brightener for copper, 0.1 – 5 g/l
Pluriol® E range (200-9000)	Polyethylene glycol	Base brightener , improves brightness and throwing power, 0 – 3 g/l
Pluronic® PE 6400	PO/EO block copolymer	Matting agent , 1 – 5 g/l
Lutron® PVI	Quaternary polyvinylimidazolium salt in water	Conditioning agent , plating through-holes, electroless copper, 1 – 5 g/l
Lutron® Q 75	N,N,N',N'-tetrakis-(2-hydroxypropyl)-ethylenediamine	Complexing agent , plating through-holes, electroless copper, 10 – 100 g/l
Lugalvan® IMZ	Imidazole	Precursor
Lugalvan® G 35	Low-molecular polyethylene imine	Leveler , acidic copper, throwing power, 0.1 – 5 g/l
Lugalvan® G 15000	High-molecular polyethylene imine	Leveler , acidic copper, throwing power, 0.1 – 5 g/l
Lugalvan® HS 1000	Thiodiglycol ethoxylate	Basic brightener , solubilizer, brightness, ductility, 0.1 – 5 g/l



Chemicals for Electroplating

Product Portfolio

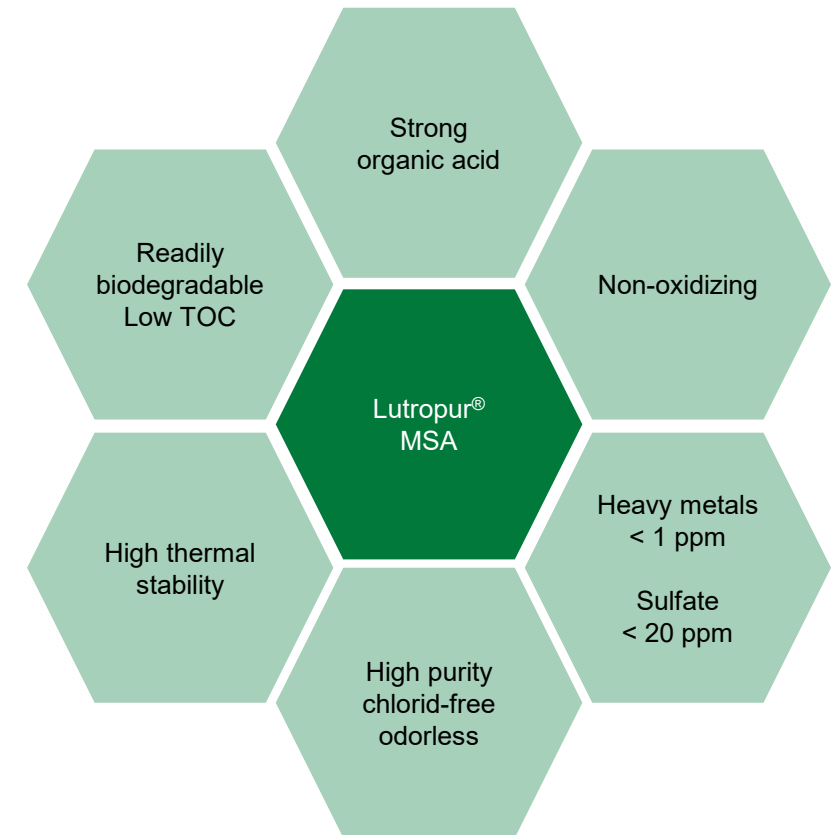
Product	Chemical nature	Function
Electroless Plating		
Lutron® PVI	Quaternary polyvinylimidazolium salt in water	Conditioning agent , plating through-holes, electroless copper, 1 – 5 g/l
Lutron® Q 75	N,N,N',N'-tetrakis-(2-hydroxypropyl)-ethylenediamine	Complexing agent , plating through-holes, electroless copper, 10 – 30 g/l
Fluxes and Heat-transfer fluids		
Lutron® HF 1	Modified polyglycol ether	Flux, heat-transfer fluid
Lutron® KS 1	Modified polyglycol ether	Flux, heat-transfer fluid

Methanesulfonic acid

Lutropur® MSA, methanesulfonic acid, is being used in a variety of applications due to its unique purity and because of the high solubility of its salts. Further purification is not necessary with Lutropur® MSA. Methanesulfonic acid is not an oxidizing agent and thus differs from sulfuric acid and nitric acid.

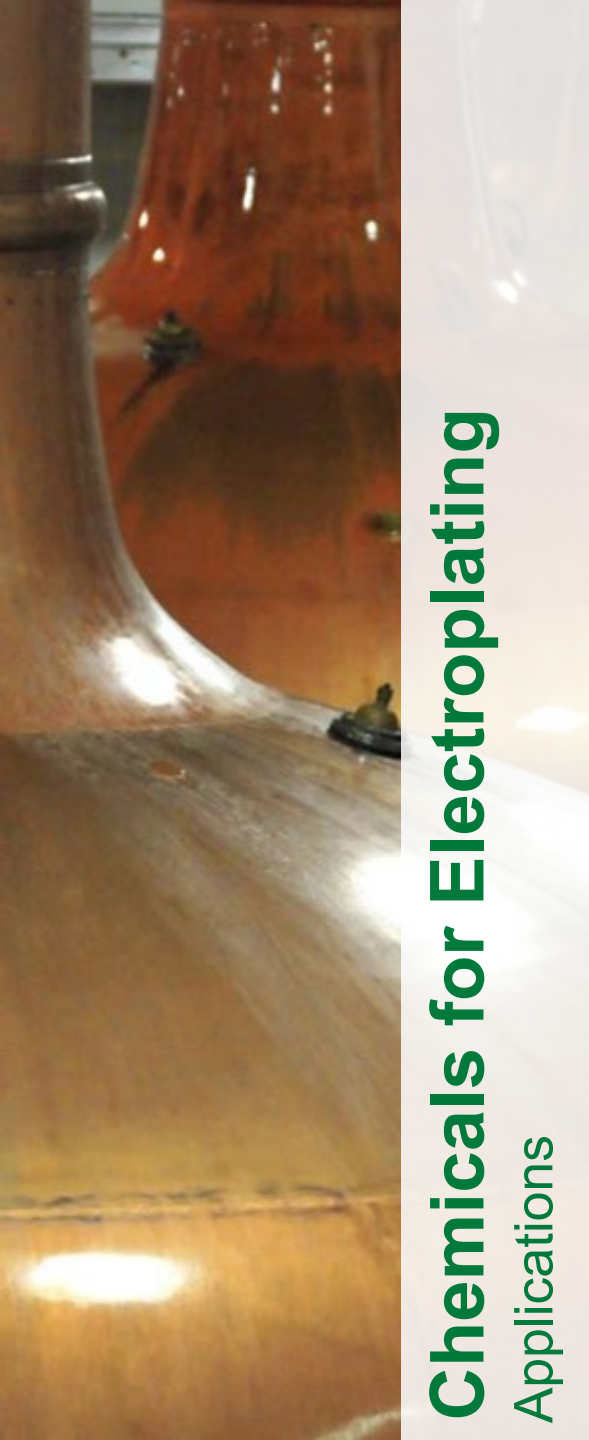
Lutropur® MSA is particularly useful for the following techniques:

- Continuous tin and tin alloy plating on substrates like steel strips and steel wire. Lutropur® MSA can be used advantageously to replace tetrafluoroboric acid, phenolsulfonic acid and sulfuric acid due to the high solubility of its salts. Lutropur® MSA has a lower carbon (TOC) content than other organic acids and thus allows easier wastewater handling.
- Stripping and metal refining.
- Pickling and electro polishing.



For further information on the extensive range of BASF products used in all areas of metal treatment, please refer to the relevant BASF brochures and booklets, as well as the website.

www.industrial-formulators.basf.com



Chemicals for Electroplating

Applications

Plastics processing

Lutron® grades can be used as a heat-transfer fluid for melting cores made from low-melting metal alloys. Cores can be melted out of mouldings by electrical induction or by conventional heating. Lutron® grades protect the metal from oxidation when it is melted. Lutron® grades have a long working life, provided very high peaks in temperature and local anomalies of temperature in the bath are avoided. Its viscosity can gradually increase over time under unfavorable circumstances, but the main factor limiting its working life is the ease with which it can be washed off from mouldings. It can be rinsed off from mouldings with water alone, and no other additives are required. It is sometimes possible to recycle spent Lutron® grades by distilling it from the rinse water, but this has to be tested in trials.

Printed circuit boards

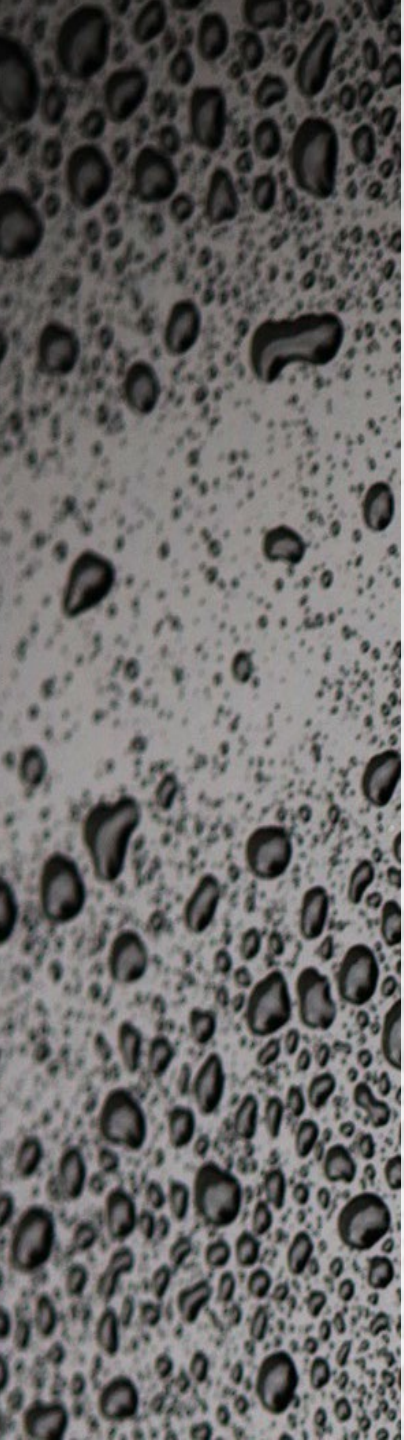
Lutron® grades are used in the production of printed circuit boards in formulations for fluxes for use in hot-air and hot-oil leveling processes, and for reflow fluids. Formulations consist of water, stabilizers, activators, organic solvents and other additives alongside our Lutron® grades.

Lutron® grades have a very high flash point and are very stable at high temperatures. Fluxes based on our Lutron® grades have an excellent wetting effect on printed circuit boards allowing very high surface resistivity to be obtained. Any flux left over after processing is very easy to wash off.

BASF – A reliable supplier

The high degree of backward integration of the BASF production process ensures a reliable source of supply.

BASF's worldwide presence with a network of production and distribution facilities in all important countries ensure that we are able to offer a quick, reliable service to the electroplating manufacturing.



Organic Sealers

Metal Surface Treatment with Lugalvan®

Versatile applications

Post-treatment

On metal surfaces, Lugalvan® DC forms a transparent film with very good adhesive capacity and corrosion protection properties. It is especially recommended for zinc-plated steel (passivated or not passivated) and Aluminum, but can also be applied on ungalvanized steel, nickel, and non-ferrous metals.

Lugalvan® DC is available as an aqueous, emulsifier-free polymer emulsion, which is miscible with water in all proportions, provided the pH value does not fall below 8.5. Experience has shown that it may be advisable to adjust the pH value at around 9 (by adding ammonia or amines) in order to prevent precipitation of the product.

It can be applied by dipping, rolling, spinning or spraying. For spraying applications, a solids content of > 10% is recommended. The thickness of the polymer film can be adjusted via the viscosity. The viscosity basically depends on the solids content and temperature of the coating bath but also on the pH value. At pH values above 9.5, the viscosity will decrease.

Usually, films of ca. 1 – 10 µm are formed from coating baths. Higher film thicknesses can be achieved through a higher solid concentration or multiple dipping. To achieve constant film thicknesses, monitoring the solids concentration in the coating bath is required. Depending on the thickness of the film, it is recommended to use higher temperatures for the drying process. However, it can also be dried at ambient temperature. Depending on size, geometry and film thickness the parts can be dried within one minute at 80°C (fan heater); higher temperatures will reduce the drying time. For increased corrosion protection drying at elevated temperature or prolonged reaction time is recommended, e.g. 10 minutes at 80°C or 1 minute at 130°C.

Primer for paints and powder coatings

Lugalvan® DC is an excellent primer to increase the adhesion on paints and coatings. This is especially the case for Zinc coated and passivated substrates because usually the adhesion of coatings on these surfaces is not sufficient.

Film properties

Lugalvan® DC has excellent adhesion to metallic surfaces. An important application is sealing of passivated zinc surfaces and aluminium. In some cases, degreasing can be omitted before applying Lugalvan® DC. Lugalvan® DC forms firmly adhering films on glass, PE, EPDM, polyurethane, nylon, and cellulose. Wetting of low-energy surfaces with Lugalvan® DC may be eased by use of solvents like alcohol

Example

Dipping a Zn plated and Cr(III) passivated steel panel for 30 sec. in a 50% Lugalvan® DC solution (=10% active material) and drying afterwards for 10 minutes at 80°C results in a homogeneous transparent film of around 3 g/m² coating weight.

The adhesion on the surface is excellent. A very good compromise of film hardness and ductility allows forming of parts after the film is already dried.

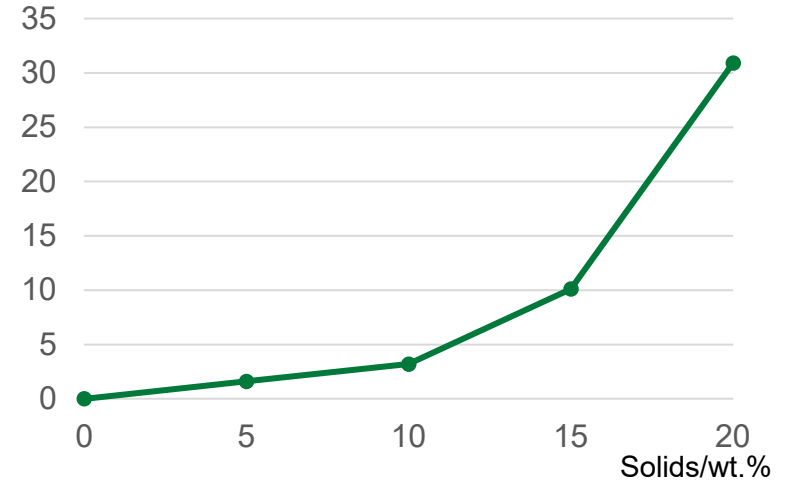
Corrosion protections in the neutral salt spray test (DIN EN ISO 9227:2012-09) results in < 5% surface corrosion after 720h of testing (with the above mentioned coated panel).

Coating weight

The coating weight achieved with Lugalvan® DC depends on the geometry of the parts and on the solids-content of the Lugalvan® DC. When using roller coating, the typical rules for coating weight apply. The coating weight for dip coating on a vertically-hanging metal sheet is illustrated in the following graph.

Dip application of Lugalvan® DC on flat panels, dried vertically:

Coating weight g/m²,
dried at 80°C, 10 min.



Alkaline cleaning

Lugalvan® DC can be removed before curing, e.g. from unintentionally coated equipment, using an alkaline stripping solution (see below). After curing, the time required for stripping will considerably increase.

Basic formulation for alkaline stripper solution:

40 g sodium hydroxide (solid)
40 g sodium gluconate
10 g Lutensol® TO 15 surfactant
30 g Glucopon® 225 DK surfactant
15 g Solvenon® PnB solvent
865 g water

Disposal

By lowering the pH value to a mildly acidic range, Lugalvan® grades can be precipitated and then separated from wastewater by means of filtration.

Corrosion Inhibitors

Product overview

Corrosion inhibitors

As in primer formulations inorganic corrosion inhibitors such as zinc phosphate, sodium silicate can also be combined very effectively with Lugalvan® DC. This also applies to organic corrosion inhibitors, and compounds such as the sodium salt of benzotriazole can be used to improve the protection of copper and its alloys.

Product	Chemical nature	Function
Golpanol® BOZ	2-Butyne-1,4-diol	Strong acidic , all steel types
Lugalvan® BPC 48	Benzylpyridinium carboxylate (48%)	Light acidic , for aluminum und zinc
Korantin® TC-SH	Oleoylsarcosine acid	Neutral to alkaline , all steel types, aluminum and zinc
Korantin® MAT	Aliphatic dicarboxylic acid mono-alkylamine in triethanolamine	Light acidic to alkaline , all steel types

Additional Products used in Electroplating

Product	Chemical nature	Function
Others		
Degressal® SD types		Defoamer
Disponil® types		Surfactant
Trilon®		Complexing agent
Pluronic® PE 6400	PO/EO block copolymer	Matting agent
Texapon® EHS (esp. for acid Zn and Ni)	Ethylhexanol ethoxylate	Anionic surfactant



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