

Hard-Ematal surface treatment for solenoid valves

Hard-Ematal coating

The surface of aluminium and its alloys is converted into a hard, very compact and isolating aluminium oxide coating, with intercalated titanium dioxide.

Treatment takes place in a special electrolyte via anodic surface conversion of the base metal, to form a hard, wear-resistant oxide, with the simultaneous inclusion of certain titanium, zirconium and other compounds. Additional additives are used to increase and stabilise those properties of the Ematal coating of particular significance for technical applications.

Hard-Ematal coatings are characterised by extremely high wear and abrasion resistance, excellent anti-friction properties and offer a high level of protection against atmospheric and chemical influences.

Complex shapes are also suitable for Ematal coating. This results in uniform coating thicknesses and properties, without essentially altering the dimensions of treated parts.

Maintaining dimensional accuracy

Whilst other coating methods (e.g. hard chrome plating) always produce dimensional changes in the treated component (thickness increase), usually unevenly distributed, this is avoidable when the Ematal process is used. Hard-ematalising can be controlled so that the dimensions of precision areas after coating are kept within extremely close tolerances (approx. $\pm 3 \mu\text{m}$).

High resistance to wear

The Ematal coating exhibits high wear resistance when exposed to friction or abrasion.

Excellent anti-friction properties

Thanks to the glaze-like, poreless surface, the Ematal coating exhibits an extremely low coefficient of friction on suitably pretreated components.

Increased surface hardness

The Ematal coating produces a good surface hardness on treated parts. Depending on the alloys used, the hardness of the Ematal coating exceeds that of quartz and topaz (Mohs scale 7:8).

High covering capability

The Ematal coating also forms with the same thickness and characteristics on very awkward areas (e.g. extremely narrow holes, threads).

Coating begins at the point with the least resistance to the flow of current, until the entire component is uniformly coated.

Other characteristics

Depending on the alloy, the colour of the Ematal coating varies from light grey to brownish grey. Where the silicon content is high, the colour is black. In the case of

heterogeneous alloys the coating reproduces the alloy texture.

In its final state the Ematal coating is a good thermal and electrical insulator (breakdown voltage approx. 35 ... 50 V per m).

Choice of alloy

The selection of the right alloy is of utmost importance in order to attain the optimal characteristics of the Ematal coating.

Just as with all other methods for electrolytically anodizing aluminium, the base material forms the skeleton of the coating. The best coating characteristics are obtained with pure aluminium, followed by all alloys which are known to be suitable for anodizing.

At Eugen Seitz AG, Anticorocal 100 (Al Mg Si 1) is most frequently used.

The insoluble bond between the Ematal coating and the base material completely excludes any possibility of the coating peeling or chipping off.

It is best to coat parts only after they have been completely formed. Subsequent machining is not recommended due to excessive tool wear.

Application

For workpieces requiring highly abrasion-resistant surfaces: rotors, disks, bearing flanges, gear units, couplings, pistons, valve housings, cogwheels, jigs and fixtures, front panels, screws etc.

Chemical resistance of Ematal coating on Aluminium

The Ematal coating is:

- 1** **resistant** against...
2 **conditionally resistant** against...
3 **resistant if** the substance is waterfree. Practically all of them are unqualified since these salts absorb water.
x **not resistant** against...

A		C			
Acetic acid	1	Calcium carbide	3	Ethyl alcohol, concentrated	1
Acetic acid concentrated	1	Calcium chloride	1	Ethyl chlorid, dry	1
Acetic ester (-ether)	1	Calcium hydroxide	x	Eucalyptus oil	1
Acetone	1	Calcium oxalate (moist)	1		
Acetylene	1	Calcium sulphate (gypsum)	1	F	
Albumen	1	Calcium sulphide	3	Fats	1
Alkali silicate	1	Camphor	1	Fatty acids	1
Allum	1	Caoutchouc	1	Ferric chloride	3
Alumina cement	1	Carbide	3	Ferrous & ferric potassium cyanide	1
Aluminum chlorid	3	Carbide mud	x	Fixing salt (fixing bath, photographic)	1
Aluminum formiat	1	Carbolic acid concentr.	1	Formaldehyde (neutral)	1
Aluminum nitrat	1	Carbolic acid diluted	1	Formic acid	x
Aluminum sulphat	1	Carbon	1	Fruit acid	1
Ammonia (ammonium hydroxide)	1	Carbon disulfide	1	Fruit essences	1
Ammonium bromide	1	Carbohydrate	1	Fruit juices	1
Ammonium chlorid	1	Carbon monoxide	1	Furfural	1
Ammonium carbonate	1	Carbonic acid (dry)	1		
Ammonium nitrat	1	Carbonileum	1	G	
Ammonium sulphate	1	Castor oil	2	Gallic acid	1
Ammonium sulphide	1	Cellulose	1	Gelatine	1
Ammonium sulphocyanate	1	Ceresine	1	Geneva (genèvre, gin)	1
Amylacetate	1	Cheese	1	Gin	1
Amylalcohol	1	Chloramine (up to 0,5%)	1	Glauber's salt (see sodium sulfate)	1
Aniline	1	Chlorinated lime	3	Glucose	1
Aniline chloride	x	Chlorine (dry)	1	Glue (of protein)	1
Aniline sulphate	3	Chlorine (moist)	x	Glycerine (glycerol)	1
Anthracene	1	Chloroform	1	Glyasantine	1
Anthrachinone	1	Chocolate	1		
Antiformine	x	Citric acid	3	H	
Apple juice (free of SO ₂)	1	Cream	1	Henko	1
		Chromic acid	3	Herring's brine	1
		Chromic alum	1	Honey	1
B		Cider	1	Hydrocarbon (aromatic)	1
Baker's yeast and baking powder	1	Cod-liver oil	1	Hydrochloric acid	x
Barium chloride	1	Cognac	1	Hydrocyanic acid	1
Barium hydroxide	3	Concrete (moist, not set)	2	Hydrofluoric acid	x
Benzaldehyde (dry)	1	Condensation water	1	Hydrogen sulphide	1
Benzene (benzole)	1	Copper limewash	1	Hydrogen peroxide	1
Benzine	1	Copper salts	3		
Benzoic acid	1	Creosote	1	I	
Beer	1	Cresol	1	Ice	1
Beeswax	1	Crotonic aldehyde	1	Ink	1
Bicarbonate of soda	1			Iodine	1
Bitumen	1	D		Iodoform	1
Black japan	1	Developer (photogr.)	1	Iron sulfate (vitriol)	1
Borax	1	Di ammoniumphosphate (up to 3%)	1		
Brandy (spirits)	1	Distilled water	1	K	
Brine for pickles	1	Dynamite (see nitroglycerine)	1	Ketone	1
Bromine	x				
Bromoform	1	E			
Bromine hydracid	x	Eau-de-cologne	1		
Butter	1	Essential oils	1		
Butyl acetate	1	Ether	1		
Butyl alcohol	1				
Butyric acid	1				

L

Lactic acid (up to 10 %)	2
Lead acetate (plumbic acetate)	3
Lead arsenat (strongly diluted solution)	1
Lead azide	1
Lead nitrate	3
Lead tetraethyl (standard solution in fuel)	1
Lemon essence	1
Lomon juice	1
Linseed oil	1
Linseed oil (varnish)	1
Liqueurs	1
Liquid manure	1
Lithopones	1
Lohtannin	1
Lysol (up to 5%)	

M

Magnesium chloride	1
Magnesium sulfate	1
Malic acid	1
Margarine	1
Menthol	1
Mercury	x
Mercury fulminate	3
Mercury salts	3
Methyl alcohol	1
Methylamine	1
Methyl chloride	1
Milk	2
Milksugar (lactose)	1
Mineral oils	1
Mineral water	1
Molasses	1
Montan resin	2
Mortar	1
Mud baths	1
Mustard	1

N

Naphtalene	1
Neradol	3
Nickel chlorides	3
Nicotine	2
Nitric acid, concentrated	1
Nitric acid, diluted	x
Nitrocellulose	1
Nitroglycerin	1
Nitrophenole	1
Nitrous vapours, dry	2

O

Oils	1
Oil of turpentine	1
Oleic acid	1
Oleum	x
Onion juice	1
Organic colouring material	2
Orange juice	1
Oxalic acid	1
Oxal ethyl ester	1
Ozone	1

P

P3	1
Palmin (coconut fat)	1
Palmitinic acid	1
Paraffin	1
Paraformaldehyde	1
Paratoluenesulfonic acid	1
Persil	2
Petroleum	1
Phenols	1
Phosphoric acid	x
Phosphorous seasquisulfid	1
Phtalic acid	1
Picric acid	1
Plasticine	1
Pickle salt and broth	1
Potassium	1
Potassium alum	1
Potassium bichromate	1
Potassium bitartrate	1
Potassium bromide	1
Potassium carbonate (cold)	1
Potassium chlorate	1
Potassium chloride	1
Potassium chromate	1
Potassium cyanide	3
Potassium hydroxide	1
Potassium nitrate	1
Potassium nitrite	1
Potassium permanganate	1
Potassium rhodanide	1
Potassium silicate, see water glass	1
Potassium sulfate	1
Preserved (canned, tinned) food	1
Producer gas	1
Propylic alcohol	1
Propyonic acid	1

R

Rainwater (stagnant)	2
Resins (colophony, copals, etc.)	1
Resorcinol	1
Rhodanic ammonium	1
Rhodanic potassium	1
Rum	1
Raspberry juice	1
Rust/Ferric oxide	1
Rye whisky	1

S

Salt of hartshorn (s. ammonium carbonate)	1
Salicylic acid (dry)	1
Salicylic acid (-solution)	1
Sauerkraut	1
Sea water	1
Silicium tetrachloride (free of water)	1
Silversalts	3
Skin cream	1
Soap solution	1
Sodium carbonte (cold)	1
Sodium chlorate (free of chloride)	1
Sodium chloride (common salt)	2
Sodium hydroxide	3
Sodium nitrate	1
Sodium nitrite	1

Sodium silicofluoride (up to 1%)	1
Sodium sulfate	1
Sodium sulfite	1
Sollution of boric acid	1
Sourmilk (up to 40° S.H.)	1
Snuff tobacco	1
Stearic acid	1
Sulfonal	1
Sulphur	1
Sulphur ammonium	1
Sulphur dioxide (liquid and waterfree or gaseous and dry)	1
Sulphureted acid (watery)	1
Sulphuric acid	x
Sulphuric calcium broth	1
Sulphurylchloride	1

T

Tannin	1
Tartric acid	1
Tar (asphalt)	1
Tar oils	1
Tea (-leafs)	1
Teetraline	1
Tetrachloric carbon (waterfree)	1
Tin chloride	3
Tincture of iodine	1
Tobacco	1
Toluene	1
Town gas	1
Transformer oil	1
Trichlorethylene (waterfree)	1
Tricresylic phosphate	1
Trisodic phosphate	1

U

Urine	1
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V

Valerian acid	1
Vapour (Water)	1
Varnish (laquer)	1
Vim	1
Vinegar	1

W

Water (see distilled water)	1
Water (tap water)	1
Water steam	1
Waxes	1
Wine	1
Whisky	1

Y

Yellow soap solution	1
Yogurt	1

Z

Zinc chloride	3
Zinc sulfate	1

