

Zinc Flake Coatings



The addition of Zinc as a functional pigment in relatively high levels to an organic binder is one of the most important types of anti-corrosion protection systems.

The anticorrosive properties of zinc as explained elsewhere are well known and documented. The shape of the Zinc particle has as much an effect upon the performance of the final paint film as the loading of the pigment into the binder system.

Spherical particles of Zinc of around $3\mu\text{m}$ in size - commonly known as Zinc dust is commercially the most cost effective method of creating a zinc loaded paint system, and there are a number of manufacturers of these systems, Trimite® Schramm® who offer a comprehensive range of finishes and performances, most of which can be supplied by the Anochrome Group for sprayed applications such as brake discs. These materials may not use a fully Zinc pigment as the anticorrosive element, but are supplemented or even totally replaced by Aluminium.

The second main type of zinc pigment is to use platelets or flakes of zinc around $15\mu\text{m}$ in size, these have an advantage over the spherical pigments as their greater surface area allows, when applied correctly, an increased contact with the substrate and with adjoining flakes improving corrosion resistance. The improvement in effectiveness of the flake also allows for a higher binder pigment ratio.

The coatings consist predominantly of zinc flakes, in some cases mixed with a small proportion of aluminium flakes. It is important in the formulation of these materials to use flakes and not zinc powder or dust, as the presence of the flakes with the correct drying and curing procedure allows a dense coating to be formed with the flakes lying parallel to the substrate surface which greatly improves the protective performance of the coating. The flakes are bound together using a matrix that can be organic or inorganic, this varies with the particular materials used. The coatings are conductive so are sacrificial to steel.

They are often used with a top coat that can improve corrosion and give barrier protection, but in this case the total coating may not be conductive.

The performance advantages of zinc flake coatings are:-

- Excellent resistance to atmospheric corrosion.
- Limited "white" rust (zinc corrosion products) or other corrosion products in service.
- Neutral salt spray corrosion resistance exceeds that of many other common surface finishes, e.g. electro and mechanically plated zinc and sheradising.
- Resistance to many "mild" chemicals and solvents including petrol and brake fluids.
- No hydrogen embrittlement. It is a non-electrolytic process.*
- Can be electrically conductive.
- Galvanic protection by the zinc-rich coating ensures satisfactory performance at bimetallic contacts with steel, aluminium, zinc and cadmium in most situations.

M24.1.1

•Complex shapes, recesses and holes are coated with suitable equipment.

•Low thicknesses can give corrosion resistance equivalent to much higher thicknesses of conventional coatings.

Typical parts zinc flake coated are:-

- Threaded fasteners particularly strength grades 10.9 and 12.9.
- Pressings, springs, clips as required for vehicles, domestic appliances and on buildings.
- High tensile steel (particularly above 1000 N/mm^2) and case hardened parts requiring surface protection without possible hydrogen embrittlement.
- Sintered and cast steel and iron components.
- Parts of complex shape and those with holes and recesses.
- Compound assemblies e.g. lock parts and hose connectors.

Note: Items which have predominantly flat or nesting surfaces may not always be suitable for bulk zinc flake coating and initial trials should be arranged. In some instances a small change in design can make items suitable. Washers are most effectively treated as captive assemblies with screws (i.e. sems) or spray coated.

Zinc flake coatings have thicknesses in the range of 5-12 microns and in contrast to electroplated coatings the coating is thicker at thread roots and in recesses, and thinner at crests and edges. Tightness to thread inspection gauges will be experienced with fine threads at M4 and below although in most situations this will not inhibit assembly into tapped holes and standard nuts. This phenomenon of dip-spin applied zinc flake coatings being thicker in recesses can ensure that recessed parts or complicated pressing with folds, etc. will have far better corrosion resistance than when electroplated due to the electroplated coatings being thin in "shielded" areas. In some cases, however, this recess build up with dip spin applied zinc flake coatings can be a major problem.

The use of zinc flake coatings by major OEM's (Original Equipment Manufacturers) worldwide has increased substantially due to the requirements for prolonged corrosion resistance and for fasteners, reproducible tightening performance. The Anochrome Group can apply licensed coatings sourced from the four major suppliers in this area, who are:

- NOF, suppliers of Geomet® 321, 500, 360 and 720;
- Doerken, suppliers of Delta Tone®, Delta Protekt® and Delta Seal®.
- Magni® suppliers of Magni 560, Magni 565 and Magni 594.
- Atotech, suppliers of Zintek® and Techseal®.

Please see further sections for more specific details of these products.

*If a component is unsuitable for mechanical cleaning due to shot entrapment or damage (thin gauge clips, etc) then cleaning by chemical methods is an option, but carries the risk of hydrogen embrittlement, with higher tensile strength steels.



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