Ferrophos® Pigments

Ferrophos is a refractory ferro-alloy developed for use in high performance specialty coatings. Its primary use is in zinc-rich coatings where it works with zinc dust to provide good corrosion resistance and weldability. Recent developments in formulation technology make Ferrophos pigment attractive for use in weldable coil coatings and conductive paints for EMI shielding.

Ferrophos® Pigments is owned by Glenn Springs Holdings, Inc., a subsidiary of Occidental Petroleum Corp.

For performance and cost savings in zinc primers, weldable primers and conductive coatings.

Glenn Springs Holdings, Inc.
970 New Highway 7
Columbia, TN 38401

Applications

Ferrophos® Pigment is a refractory ferro-alloy developed for use in high performance specialty coatings.

Its primary use is in zinc-rich coatings where it works with zinc dust to provide good corrosion resistance and weldability characteristics. Ferrophos has been successfully formulated in both organic and inorganic coatings for the automotive and marine/industrial primers markets. Recent formulation technology make Ferrophos pigment beneficial for use in weldable coil coatings and conductive paints for EMI shielding.

Physical Properties

Ferrophos®, a grey ferro-alloy pigment, consists primarily of Fe2P with traces of FeP and SiO2. It is electrically and thermally conductive and chemically inert under normal conditions. Its particles are angular and are comparable in size and distribution to zinc dust particles. Ferrophos melts at 1320°C, 900°C above zinc's melting point, and within 200°C of that of carbon steel.

Advantages

Corrosion Resistance

Zinc-rich coatings protect steel by anodic dissolution of zinc dust. For zinc to dissolve anodically and provide cathodic protection, there must be a continuous electrical path between zinc particles and the steel substrate. This process is intensified when Ferrophos pigment is part of the zinc-rich coating system. Ferrophos, being highly conductive, sets up a galvanic couple and provides an electrical path between zinc particles, permitting the formation of electron transfer sites and providing more effective zinc usage.

The extent to which the zinc is replaced depends upon the type of coating, the application involved and film thickness requirements.

Up to 40 percent Ferrophos has been found effective in weldable primers and full film primers requiring a high level of corrosion protection. Lower substitution levels may be more appropriate for very thin film primers where the amount of zinc dust per unit area is very low.

We recommend running a test series to determine the optimum Ferrophos level for each specific formulation.

Gas Torch Cutting Speed

Gas torch cutting speeds were increased by 25 to 50 percent depending upon the coating thickness, type of fuel and the ratio of Ferrophos to zinc dust in the primer. Steel coated with three mils (75 micros) of zinc-rich primer containing Ferrophos was cut as quickly as steel coated with one mil (25 microns) of 100 percent zinc primer.

Cont.

Typical Ferrophos properties
Specific gravity …… 6.53
Bulking value …….. 54.5 lbs./gal.
Apparent density …….19 lbs./gal.
Typical oil absorption …
Superfine 2131: 8.9
Microfine 2132: 10.1

Pigment Grades
Particle Size (Microns):
Superfine (HRS 2131)
Typical median size—5
Top particle size (99% less than) - 32
Microfine (HRS 2132)
Typical median size—4
Top particle size (99% less than) - 26

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Advantages (cont.)

Corrosion Resistance

Weld strength and electrode wear are two important concerns in spot welding.

Welding tests on all-zinc and Ferrophos/zinc-primed steel showed that after 2,000 continuous spot welds, primers containing Ferrophos maintained a nugget size more effectively than did the all-zinc primers. Nugget size is directly proportional to weld strength, making the addition of Ferrophos advantageous.

Electrode wear was also investigated since electrode copper tips react with zinc vapor, shortening the useful life of the tips. Primers containing Ferrophos extended tip life.

Arc and torch welding tests at several shipyards clearly showed that Ferrophos coatings provided these major advantages: greatly reduced zinc smoke, low to zero weld porosity and easier slag removal -- all due to the refractory nature of Ferrophos. The conductivity of Ferrophos also contributed to improved strike and continuity. All of these advantages helped to increase welding speed.

Tests at a major corporation to determine the effects of coatings containing Ferrophos on the mechanical properties of the weldment, showed no apparent lowering or enhancement of the mechanical properties.

The addition of Ferrophos to zinc-rich coatings reduced burn-back substantially because Ferrophos melts at a much higher temperature than zinc.

Top Coat Advantages

A typical zinc-rich primer protects by sacrificing itself in preference to the steel substrate. During this sacrificial process, zinc salts are formed within and on the primer's surface. These salts can cause adhesion problems with existing topcoats or topcoats that are applied after the primer has been in service for some time.

Using Ferrophos in these coatings reduces the amount of zinc salt formation. This reduction in zinc salting generally improves topcoat adhesion and lessens surface preparation time and expense when the zinc-rich coating has been in service before being top coated.

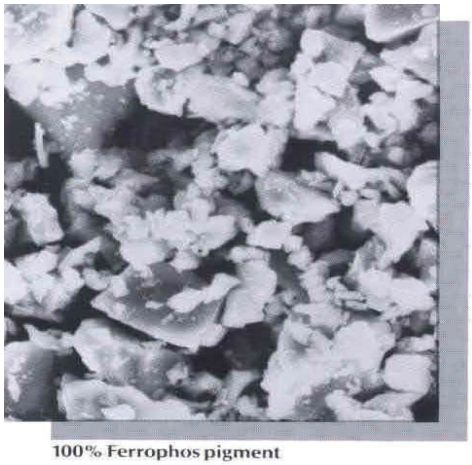
Coating Conductivity

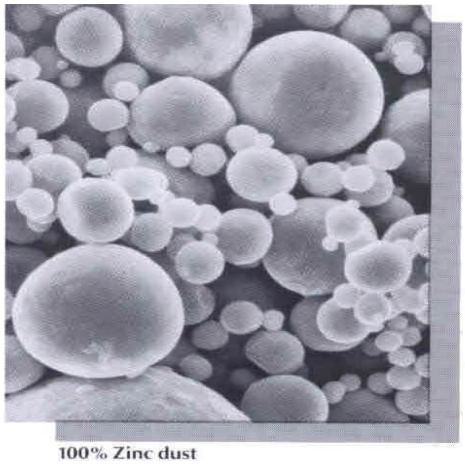
Two key properties of Ferrophos pigment in zinc-rich primers are its high conductivity and relative inertness. There properties are also important in electromagnetic interference (EMI) shielding and anti-static coatings.

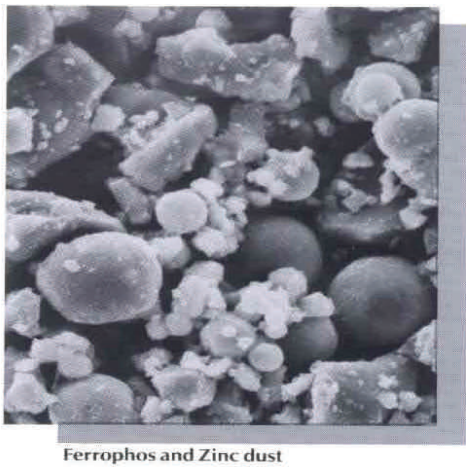
As with zinc dust in sacrificial corrosion-resistant coatings, Ferrophos was found to be an effective partial substitute for nickel pigment in providing enough conductivity for shielding while substantially reducing raw material cost. Tests have been run to determine the effect of Ferrophos alone and in combination with nickel pigments for EMI shielding.

Forty five percent Ferrophos substitution for nickel pigment in a typical EMI shielding formulation yielded results of one ohm square surface resistivity, with shielding of 30 to 45 decibels attenuation over the range tested, 0.1 to 1,000 mega Hertz.

100 percent Ferrophos pigmented coatings have also been used in anti-static coatings where conductivity requirements are less demanding than EMI shielding.


100% Ferrophos pigment


100% Zinc dust


Ferrophos and Zinc dust