Kraft Micaceous Iron Oxide – in Ethylsilicate-Zinc Primers
Barrier Effect Shingle Effect
Impermeability to UV-Rays
Heat Resistance
Stability against Environmental Influences

Introduction

Micaceous iron oxide has been used as a pigment for protective coatings for nearly a century and has an established track record for long term corrosion protection of structural steelwork.

Kraft Micaceous iron oxide - is a natural product, grey in colour with a metallic sheen and a lamellar structure.
The protective properties are due to the flaky particle structure and chemical inertness. Kraft Micaceous iron oxide is non-toxic and does not react with paint media.

Kraft Micaceous iron oxide - properties in paints

The benefits of Kraft Micaceous iron oxide in protective coatings can most aptly be described as:

- Barrier effect
- Shingle effect
- Impermeability to UV-rays
- Heat resistance
- Stability against environmental influences

The lamellar Kraft Micaceous iron oxide is especially effective in protective coatings due to the orientation of the thin platelets wit the paint film parallel to the substrate. A network of overlapping flakes, similar in effect to roof tiles, consequently forms in the coating, resulting in a dry film which acts as a barrier against the penetration of moisture and pollutants.

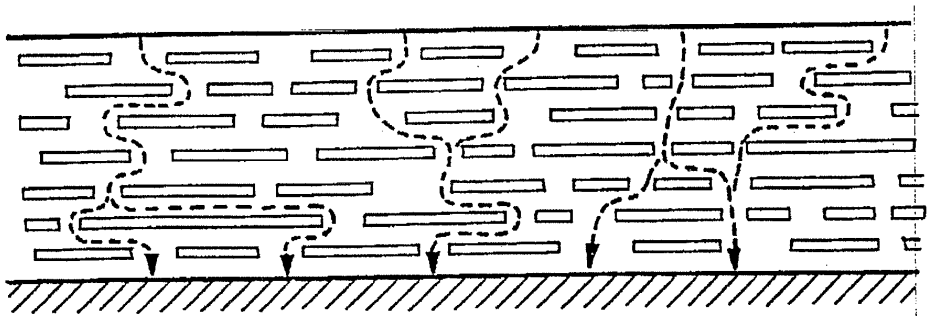

Fig. 1 is a diagrammatic cross-section of a Kraft Micaceous iron oxide - pigmented coating showing how parallel pigment layers can impede rapid penetration of moisture and pollutants. The interleaving particles also reinforce and strengthen the paint film.

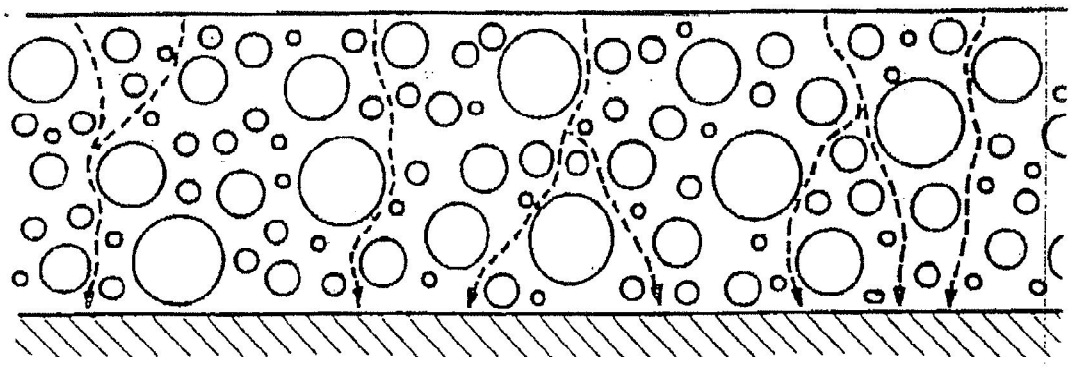

Fig. 2 demonstrates a cross-section of a paint film with conventional pigments showing, short penetration paths for moisture and pollutants. They offer no barrier effect.

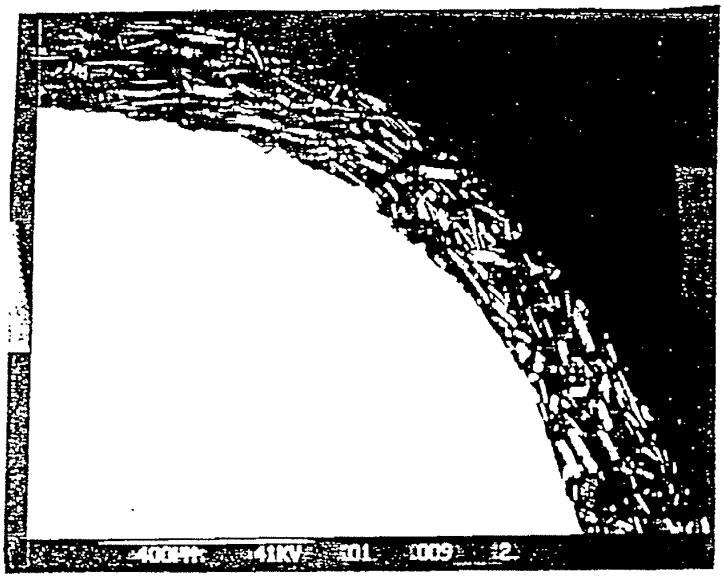

Fig. 3 is a scanning electron microscope photograph of a cross-section of Kraft Micaceous iron oxide paint film clearly showing the orientation of the particles parallel to the steel surface. Magnification x 400.

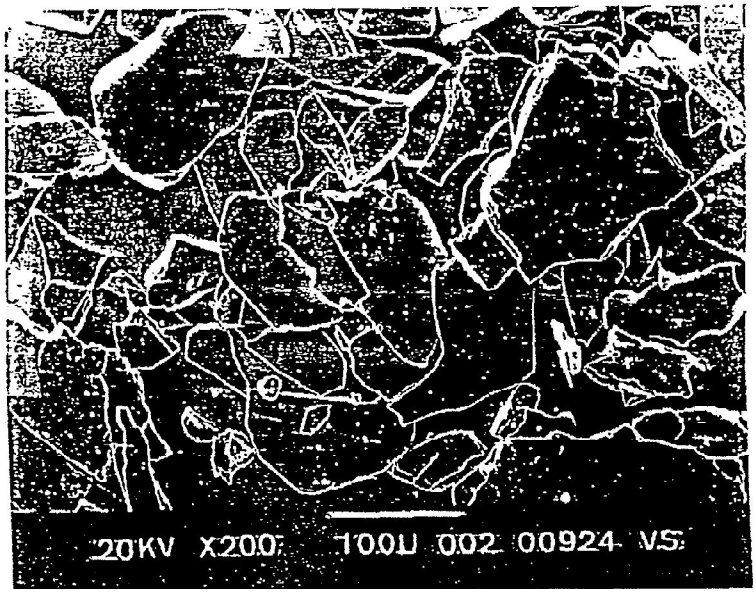

Fig. 4 is a scanning electron microscope photograph of Kraft Micaceous iron oxide showing the lamellar flaky structure of the pigment. Magnification x *200*.

Kraft Micaceous iron oxide is mostly used in intermediate and topcoats. Kraft Micaceous iron oxide can be used in all the normally occurring resins.Because of its inert behavior no special precautions are necessary. In general, it can be said that the inclusion of Kraft Micaceous iron oxide will always upgrade the protective properties of the coating. Organic binders vary in their resistance to moisture permeation and resistance to various chemical influences.

Kraft Micaceous iron oxide paint systems have been used for many decades to protect road and railway bridges, electricity transmission towers, transformers, building frames, gas holders, chemical plants, marine structures, offshore platforms and drilling rigs, storage tanks and pipework.

Primers

Compounds that perform an active role in preventing corrosion of a substrate must be close to the substrate and are therefore incorporated into the primer layer.

Anticorrosive pigments inhibit rusting by chemical reactions. Many of those pigments were based on lead or chromium. At present, phosphates of zinc or/and aluminum are dominant as anticorrosive pigments, as well as metallic zinc in the form of zinc dust.

Zinc is less noble than iron. It forms ions more easily than iron and the oxide layer formed around the pigment particles is an electron conductor. Used as a pigment in primers it gives cathodic protection to the steel surface.

Kraft Micaceous iron oxide can be incorporated in primers in conjunction with these inhibitive pigments to strengthen the film and improve the barrier properties. Usually a grade with smaller particle size is used.

Kraft Chemical

Ethylsilicate-Zinc Primers

The excellent anti-corrosive effect of zinc primers is due largely to cathodic protection which requires close contact between the zinc and the steel surface. In zinc-rich primers the zinc content of the dry film is about 90% per weight.

Zinc-rich paints based on ethylsilicate have been used for many years for the effective protection of steel against corrosion in aggressive atmospheres. Their widespread use is due to their outstanding properties:

- Fast curing, even under extreme conditions(- 15°C to ÷ 50 °C up to 100% relative humidity)
- Excellent adhesion to clean surfaces
- Long term heat resistance up to 420°C and to fluctuating temperatures.
- Easy to weld
- Excellent protection against rust migration underneath the paint film

However there are two properties which should be improved in these types of paints:

- Mud cracking – both one-pack and two-pack zinc-rich formulation have a very marked tendency to mud cracking if the dry film thickness gets over 80 – 90 µm.
- Pinholes

The reason for it is the high pigmentation level and the porous nature of the film in the drying phase. This depends also on the particle size of the zinc dust, film thickness, drying conditions (temperature, relative humidity) and type of the following coat.

To avoid such pinholes the use of a sealer coating is widely accepted. This is a low level, or unpigmented paint in a thin layer which seals the porous primer - a so called "mist coat".

Back to mud cracking

The tendency to mud cracking in zinc-rich formulations has its primary cause in thee of binder. It depends also on the ratio of ethylsilicate to zinc dust. If too little pigment is used, the film cracks. If, on the other hand, the pigment content is too high, the film will be soft and have poor adhesion.

The risk of cracking can be reduced by incorporating small amounts of platelet shaped pigments such as aluminum or mica. The high oil absorption of mica and reactivity of aluminum powder limit their possibilities.

This was the reason to look again at previous work on zinc/Kraft Micaceous iron oxide combinations.

These tests were done with Kraft Micaceous iron oxide AS, at that time the type with the smallest particle size. Compared with the particle size of zinc dust it seemed to us that we should use a lamellar micaceous iron oxide with much smaller particles. With Kraft Micaceous iron oxide SF we are now producing such a "superfine" type.

Conclusion

By summarizing the results it can be said that by combining zinc and Kraft Micaceous iron oxide SF in ethylsilicate primers the film properties were substantially improved:

- no mud cracking up to 250 µm
- reduced formation of pinholes in the following coat
- lower tendency to generation of zinc salts under humid conditions
- improved adhesion on steel substrates