

MIO COATINGS – WHAT ARE THEY?

WHAT IS MIO?

Micaceous Iron Oxide (MIO) is iron oxide in a form that resembles mica, a highly structured, layered mineral (crystalline Fe_2O_3). Minerals with this highly layered structure are termed lamellar. When MIO pigments are ground into smaller, finer particles, they tend to cleave along their layers, revealing flat, shiny faces that act like tiny mirrors. These tiny mirrors reflect UV light, protecting the resin from degradation and give the coating an attractive “sparkle”. The lamellar shape also offers additional barrier protection. MIO pigment is also completely inert, non-toxic, and withstands temperatures to 1,000°C.

So, for many reasons, MIO pigment is outstanding for the protection of steel.

WHAT COLOUR IS MIO?

The natural colour of MIO pigment is a dark, charcoal grey. Some MIO coatings also contain aluminium flake (another lamellar pigment) to lighten the colour.

HOW DOES MIO WORK?

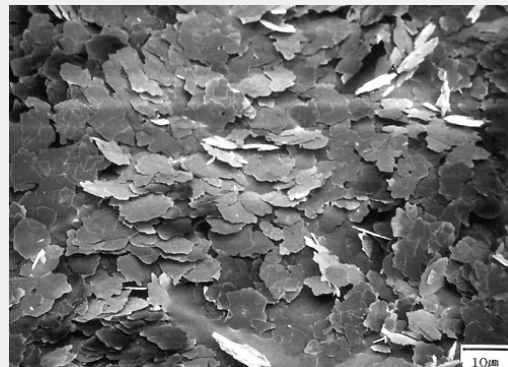
Steel is chemically unstable - it rapidly rusts in the presence of oxygen, water and salts to form iron oxide (rust). Iron oxide is chemically stable, as it cannot rust any further. Therefore, iron oxide is an excellent pigment, and MIO even better, for use in protective coatings for steel. Furthermore, the lamellar shape of this particular form of iron oxide offers greatly enhanced barrier protection.

The lamellar nature and shiny surface appearance of MIO pigments also offer UV protection to the underlying resin system. Epoxy and enamel based coatings normally chalk on exposure to UV, however, in coatings pigmented with MIO, only the resin on the surface of the uppermost MIO particles are exposed to UV and will chalk. This chalky material readily weathers off, revealing clean, shiny pigment surfaces that give the coating increased sparkle.

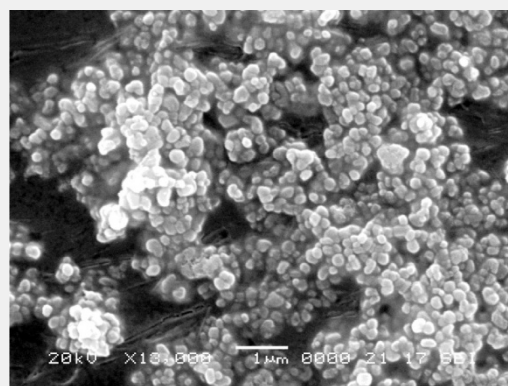
HOW DOES A LAMELLAR-PIGMENT BASED COATING FORM A BARRIER?

Most pigments used in the coatings industry are roughly spherical in shape when viewed under the microscope. These pigments may contribute to opacity, colour, resistance to abrasion or other properties, or they may be mere fillers. The most common pigment in paints and coatings is titanium dioxide, due to its very high opacity (hiding power) and its spherical particles. The spherical shape aids the flow out and gloss level, allowing formulation of coatings of exceptional gloss.

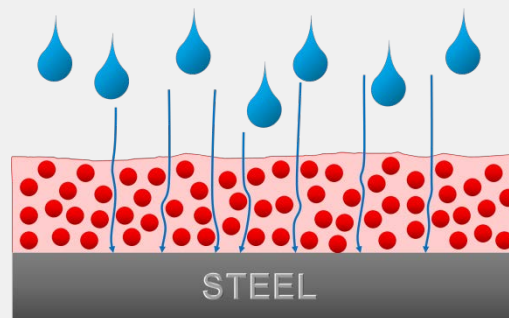
Lamellar pigments, such as micaceous iron oxides and glass flakes, are used specifically for their ability to greatly enhance the coating's barrier properties. The flakes themselves provide a “tortuous path” for any molecule that may be detrimental to the substrate, as shown schematically on the right.



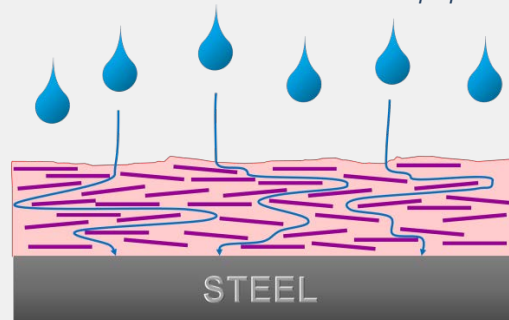
Micaceous Iron Oxide is lamellar (flat) and shiny



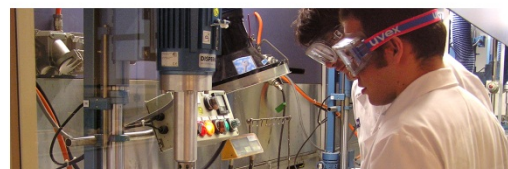
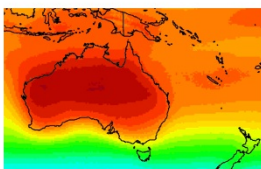
Titanium dioxide is spherical



Spherical pigments do not impart any barrier properties



Lamellar pigments have excellent barrier properties as they provide a tortuous path to water molecules



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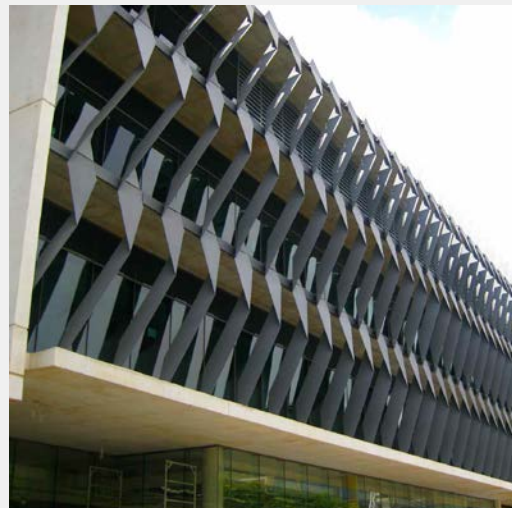
MAJOR STRUCTURES PROTECTED BY MIO

- ABC Centre, Brisbane
- Westgate Bridge Melbourne
- Sydney Harbour Bridge
- Eastlink Freeway Overpasses
- Sydney Casino
- Lady Eleanor Schonell Bridge Brisbane
- ULR Motors Showrooms
- Melbourne Museum
- Emmerich Rhine Bridge Germany
- North Sea Oil rigs UK
- Tower Bridge UK
- Severn Suspension Bridge UK
- Eiffel Tower France
- Auckland Harbour Bridge NZ
- Hawkesbury River Bridge

WHAT TO CONSIDER WHEN USING MIO COATINGS

MIO coatings were designed for protection of steel, NOT as decorative finishes! Nevertheless, MIO coatings are widely used specifically for their sparkly finish and “industrial” look. If the MIO coating is required as a decorative finish, the following points must be noted:

- **COLOUR VARIATION BETWEEN BATCHES** – The major pigment in the paint is actually natural micaceous iron oxide. This naturally occurring mineral is mined from a number of sources, and therefore colour variation can occur between batches depending on the exact source of the MIO. Variations in colour consistency may be minimised by using the same batch of paint.
- **PERCEIVED COLOUR VARIATION ON A SAMPLE** – MIO has a strong “flip” typical of metallic finishes – that is, the colour varies depending on the viewing angle. The colour can appear very light in one angle, but much darker at another angle. Therefore, trying to match an MIO (or any metallic finish) with a solid colour is difficult, as it all depends on which angle you view the sample!
- **COLOUR VARIATION WHEN VIEWED IN SITU** – Brush, roller and spray all have very different appearance, because each application method results in the MIO particles being deposited on the surface very differently. Differences in spray equipment (conventional versus airless spray), spray tip size, fan size, spray distance and other spray technique variations can all result in significant differences in colour, texture and sheen level. The direction of spray is particularly important; applying the paint over two panels, in the same direction, then turning one panel 180 degrees will result in apparent colour variation between the two panels due to “flip”. Also, spray overlapping can be obvious.
- **TEXTURE VARIATION** – Application by roller or brush generally results in a vastly different finish from that of spray application, as the MIO pigment particles are highly irregular in shape, and therefore inhibit the natural flow-out of the wet paint. When brushing, the brush hairs drag and align the MIO particles linearly in the direction of the brush-stroke, whereas spray application disperses the MIO particles randomly and uniformly. MIO paints exhibit higher brush-marking, roller-marking and stipple than other types of paint.



The striking screen feature on the ABC Building in Brisbane is protected by Ferreko No 3



The barrier protection offered by MIO is perfect for these quirky upside down ‘Floats’ umbrellas!



Brushmarks and direction of application both affect finish and colour perception

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- **VARIATION IN TOUCH UP APPEARANCE** – Touch-ups are usually difficult to blend in with any type of paint, but with MIO coatings, this problem is compounded by the coarseness of the MIO pigment. Touch-up appearance can be lessened, however, by using the same application method as that used originally (eg. a touch up spray unit for sprayed areas, or a roller with the same nap as that used for the rolled areas).
- **POSSIBLE VARIATION IN APPEARANCE BETWEEN START OF JOB AND END** – As MIO pigment is heavy, it settles to the bottom of the container. Therefore, thorough mixing before application, and frequent mixing during application are essential to ensure a consistent finish and prevent variation across a job.
- **COLOUR VARIATION ON UV EXPOSURE** – This is only a problem with epoxy and alkyd enamel MIO coatings; the colour appears to lighten (and become more “sparkly”) with exposure to UV (sunlight) due to surface erosion of the resin, exposing the MIO pigment to direct sun. Whilst this phenomenon can be seen as a virtue from a design point of view, it can also present aesthetic problems in broad areas that are partly shaded (such as under eaves) or receive variable amounts of sunlight. The north face will fade the most, whilst the south side and shaded areas will remain darker. Further erosion is prevented however, by the protection of the exposed MIO particle.
- **MARRING OR MARKING ON CONTACT** – In areas where people are likely to come in contact with the coating system (such as walls, columns, handrails, etc.), coarse flat MIO finishes will mark very easily, rather like emery paper does when used. And just like emery paper, flat MIO finishes cannot be cleaned, as the cleaning cloth or sponge will shred and also leave a mark! Therefore, flat MIO coatings are unsuitable in easily accessible areas. The only way to reduce marring is to specify a smooth, semi-gloss MIO finish such as Weathermax HBR MIO or Metalshield QD Topcoat MIO.

THIS IS HELPFUL, BUT I STILL WANT AN MIO LOOK

Basically, if the marring issue (above) is of concern, you need to specify an appropriate MIO coating with a gloss to semi gloss finish, or, perhaps choose a metallic coating that looks like an MIO!

COLOUR RANGE

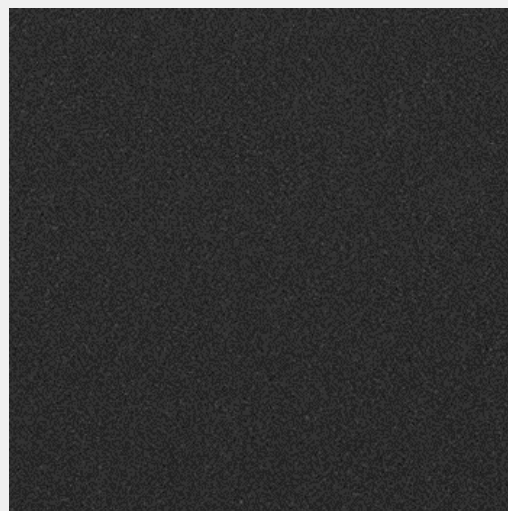
True micaceous iron oxide is very dark grey to almost black, but other shades are created by replacing some of the pigment with aluminium flake. Curiously, the aluminium flake reduces the sparkly appearance of the MIO pigment.

To create other colours would require substantial removal of the very dark MIO pigment, greatly diminishing the protective properties of the coating.

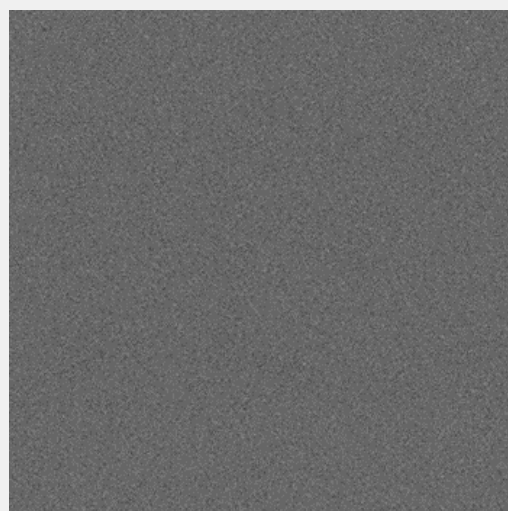
CONCLUSION

MIO coatings offer excellent corrosion protection and long-term durability. The use of MIO coatings as decorative finishes must be carefully considered, particularly in areas subject to wear and tear or exposed to UV light.

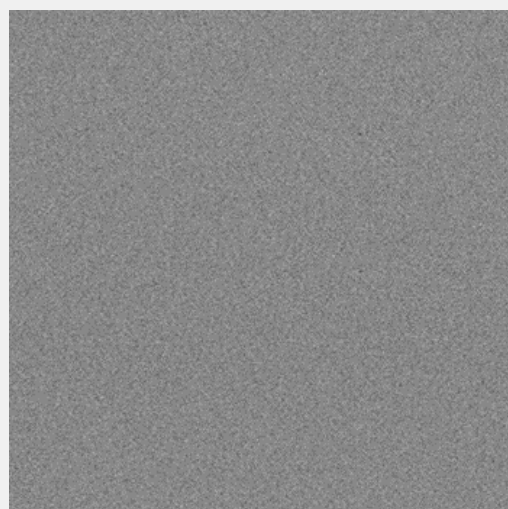
For more information on different types of MIO coatings, please refer to Tech Note 5.2.2.



Dulux MIO Natural Grey



Dulux MIO Mid Grey



Dulux MIO St Enoch Grey

For more information, please contact the Dulux Protective Coatings Technical Consultant in your state.