

Background

Over the last six or seven years there has been an ongoing discussion in the corrosion protection industry regarding which is best, Pure Epoxy or Modified Epoxies. Naturally it is not an issue of which is best as such, but rather, which product best suits the needs of that situation.

In this paper, we shall focus on the requirements of maintenance of existing structures that have previously been coated. The needs of newbuildings will therefore not be covered.

In order to choose the correct coating system it is important to fully understand the parameters to which these coating systems shall perform.

- Lifetime requirement
- Preparation standards
- Compatibility with underlying system
- Available time for re-coating process
- Rules & Regulations / Health & Safety

It is assumed that the maximum lifetime possible out of the coating system is required, for this to be the case, the product has to have optimised adhesion to the surface prepared in the chosen manner.

If, as is normal in maintenance, the surface preparation is water jetting or hand tooling then it is important that the chosen coating has good wetting properties and can penetrate into the substrate. This is especially important when docking in areas with less than perfect work practises in the yards. Likewise if there is remaining existing coating, the new coating must be compatible and be able to adhere properly.

In most cases it is important that the maintenance work is carried out with little interruption in operational activities. Therefore the coating must allow for application in less than ideal conditions.

As for Rules & Regulations and Health & Safety issues, these are laid down by governing bodies and own company policies and the coating chosen must meet these requirements.

The Coatings

When comparing Pure Epoxies with Modified Epoxies, Modified Epoxies can be classed as Pure Epoxies modified with additives, or products formulated with these built in modifications such as, Coal Tar Epoxies and Epoxy Mastics. If we ignore additive use, which has some limited benefit, we are left with three product groups: -

- Coal Tar Epoxies
- Epoxy Mastics such as Jotamastic and Balloxy products
- Pure Epoxies

Each product group have their various benefits, and it is a matter of looking at each and defining which benefits are required for the specific situation.

Coal Tar Epoxies (CTE)

We start with Coal Tar Epoxies as they have traditionally been used as general corrosion protection and have been seen over many years to provide good results.

Coal Tar Epoxies consist of the basic Epoxy resin, modified with a Coal Tar and subsequently hardened with a curing agent. The two materials combine the good properties of both the Epoxy and the Coal Tar to form a superior water resistant coating. The Coal Tar gives flexibility, greater water resistance and much better substrate tolerance than for example a Pure Epoxy.

The disadvantages of Coal Tar Epoxies are first of all:

- The dark colour makes application and inspection in tanks/confined spaces difficult.
- The tar will “bleed” into any topcoat making tar-containing paints unsuitable above the water line if appearance is a critical parameter.
- The Epoxy component may cause eczema and allergic reactions.
- Tar may irritate the applicator's skin and cause skin cancer. Particularly in combination with direct sunlight.

Due to these disadvantages, especially related to the health and safety/rules and regulations these products are generally not considered suitable anymore.

Epoxy Mastics

Epoxy Mastics, over the past decade have proven to be a tremendous success in the coatings industry - especially for simplifying the maintenance procedure.

Epoxy Mastics have certain similarities to CTEs, but rather than using the Coal Tar, the Epoxy resins are modified with a refined hydrocarbon resin. The hydrocarbon resin is used to enhance the moisture resistance, flexibility and the wetting properties of Epoxy coatings, without any of the negative aspects seen with the Tar Epoxy.

More specifically, Jotun's Epoxy Mastics can be characterised by: -

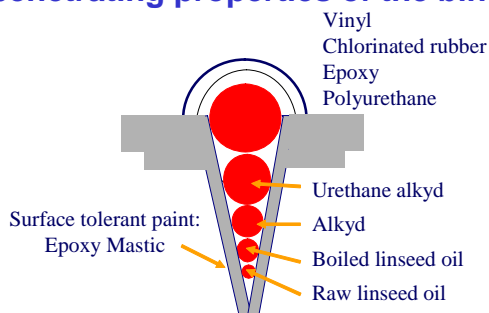
- The colour has been changed from black (or dark brown) to light colours to improve the painting conditions in confined spaces. The application is easier as the applicator himself can see the result while application takes place and takes care of SOLAS requirements in ballast tanks.
- For the same reason as above inspection is simplified and, thereby, the safety is improved.
- The Mastics show excellent penetrating properties, and can be used on almost all types of substrates.
- They have high solid by volume, 75–100% which reduces the VOC emission
- The Mastics causes no bleeding into the topcoat
- They contain no Coal Tar (Coal Tar can create cancer).
- The mixing control in Balloxy products, with the two components being different colours and visually not completely mixed until the colour is uniform.

Epoxy Mastics are specially designed to be all-round, surface tolerant coatings. The reasons for the very good penetrating properties are the small sized molecules and the

low viscosity of the binder, giving good flow. As such they can be used with very good results on hand and power tool cleaned surfaces, water jetted surfaces, Magnesium descaled surfaces (electrolytic descaling) and on blast cleaned surfaces. In sum this gives Epoxy Mastics added flexibility to the owner/operator with regards to where and when to dry-dock the vessel.

The diagram below shows different size molecules 'flowing' into the profile of the steel substrate, or in the case of the larger Epoxy molecules etc... 'Sitting' on the surface. The hydrocarbon resins are small and allow the Epoxy Mastics to penetrate deep and create optimised adhesion on reduced surface preparation.

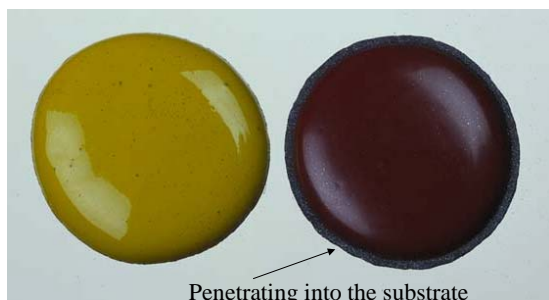
The surface tolerance depends on the penetrating properties of the binder



The surface tolerance of modified epoxies reduces the amount of time required for surface preparation and therefore out of service time and expensive grit blasting. If we take the example of ballast tanks on board a ship. An Epoxy Mastic, such as Balloxy HB Light, can be utilised on water jetted surfaces, whilst the whole operation is carried out in service. For example a VLCC carrying out a full ballast tank refurbishment could save up to 80 days in dock or alongside. It is also this surface tolerance combined with high levels of abrasion resistance that provides durability of the coating and therefore long life, even on these types of surface preparation.

If damages occur subsequently in service, for example mechanical damages in cargo holds or even de-staging of the ballast tanks after coating, the penetration of the Epoxy Mastics prevents under cutting corrosion keeping the coating in better condition for longer than Pure Epoxies.

Pure Epoxy vs Epoxy Mastics



Penetration of Epoxy Mastics



Pure Epoxies require better surface preparation than with the Epoxy Mastics. It should be noted that Pure Epoxies exhibit certain other benefits, such as fast drying and/or re-coating time. However, these benefits are usually more relevant for newbuildings and not so much during maintenance.

There are certain areas where they will be best suited for maintenance such as drinking water tanks and Ice Breaking qualities.

Conclusion

When carrying out maintenance there a number of factors that need to be satisfactorily taken care of: -

- Lifetime requirement
- Preparation standards
- Compatibility with underlying system
- Available time for re-coating process
- Rules & Regulations

In general terms, Jotun is of the opinion that Epoxy Mastics, such as Jotamastic or Balloxy products best fulfil these needs.

Additionally, taking the whole job into consideration, preparation and application costs, Epoxy Mastics will usually offer, the most cost effective solution compared with Pure Epoxies.

To ensure the best solution in each separate case, a detailed discussion between owner/operator and coating supplier must be carried out to find the optimal solution.

Miles Buckhurst
Product Manager
Jotun Coatings