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Function of Zinc Oxide in Antifouling Paints

This document outlines how zinc oxide is used in antifouling paints and provides a general explanation of the function of zinc oxide in antifouling paints. From this it is clear that zinc oxide is added to antifouling paints to fulfil a non-biocidal function. It should be noted that in most countries with existing registration schemes for antifouling paints, zinc oxide is not considered a biocide.

**Zinc oxide - function in A/F Paints**

In antifouling coatings zinc oxide is added to the formulation to:

* Regulate the dissolution of the paint film during service (i.e. control the film polishing rate)
* Stabilise wet paint in the can
* Modify dry film properties e.g. act as a UV absorber
* Pigment the system

Zinc oxide is primarily used in antifouling paints due to its unique solubility characteristics. In addition, zinc oxide has a number of properties described in the following sections, which are beneficial for the final antifouling formulation. To date no alternatives have been found that provide the equivalent solubility characteristics of zinc oxide.

**Regulation of dissolution of the paint film during service**

Controlling the solubility of the paint film, and hence the polishing rate, is critical to the effective performance of the paint. Zinc oxide is a critical paint ingredient used to control the polishing rate of the paint. Creating a paint that is too soft (i.e. having poor mechanical integrity) when dry will mean that it polishes away rapidly revealing the inert undercoating and making it accessible to fouling. In combination with the resin system chosen, zinc oxide is incorporated into the film at the product design level to give the right balance of mechanical strength and solubility. This ensures that the required in service life time is achieved.

**Stabiliser for wet paint**

Zinc oxide combines readily with free acid groups present in the paint to form zinc soaps. If not neutralised, the acids might, react with other paint ingredients and lead to the formation of an unstable wet paint. Viscosity increase or even gelation could be the result of such incompatible systems. Other compounds with the same properties of neutralising free acid groups exist, but the solubility characteristics of these compounds are not suited for use in antifouling paints.
Modify dry film properties
Zinc oxide absorbs ultra-violet light which is damaging to the stability of organic biocides and some binder systems. For antifouling paints this is an important issue whenever films are not continually immersed e.g. the boot-top area, or in cases where extended dry-docking periods are required (such as in yacht refitting). Zinc oxide actively absorbs UV and hence protects photo-sensitive binders and pigments from degradation by UV-light. Current alternatives to zinc oxide do not show comparable UV-absorbing properties.

Pigment in the system
Zinc oxide can be used to create the desired colour of the paint system (especially for white and bright colours) i.e. zinc oxide acts as a pigment in this context. Other antifouling coating pigments can be used but do not have the same opacity or are prohibitively expensive.