



WHITE RUST

White Rust is the water treater's terminology for the adverse syndrome of corrosion of the zinc based protective coating of cooling towers. The corrosion of these protective coatings usually appears as a white, waxy, adherent deposit on the coating's surface.

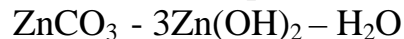


BACKGROUND

Open evaporative cooling water circulation systems require large amounts of cooling water. These cooling waters are continually being evaporated through the cooling tower systems to the atmosphere. This evaporation creates the need for make-up water to replenish the evaporative loss.

Make-up water commonly contains impurities and contaminants, including dissolved gases, dissolved chemical compounds and suspended matter. Over time, with evaporation loss and recurring make-up, the levels of these impurities increase. With the increase in levels of these impurities comes an increase in carbonate alkalinity and pH. This elevated carbonate alkalinity and elevated pH result in corrosion of zinc based coatings. This corrosion mechanism is referred to as White Rust.

White Rust is identified as a corrosion mechanism of carbonate ions and zinc that produce the compound:



This corrosion mechanism results in the loss of corrosion protection of the ferrous metal substrate by the zinc coating of the cooling tower.

White Rust corrosion of a tower quickly renders the galvanized coating ineffective in its ability to perform as either a sacrificial anode or as a barrier coating. Often times the corrosion cells of White Rust induce localized corrosion cells on the underlying steel substrate, resulting in ferrous metal corrosion (red rust), which necessitates remedial action to avoid tower failure.



GALVANIC SYSTEMS CHANGES

In the 1980' the process of galvanize manufacturing was changed including:

- Alloy metal changes including Al, Mg, Pb
- Removal of the chromate rinse stage
- Continuous sheet process instead of open-dip process

Environmental pressures necessitated the change from acid-chromate cooling water treatment to alkaline based molybdates, organic polymers and phosphonates.

The addition of polymeric scale inhibitors tend to accentuate the White Rust corrosion problem. These scale inhibition polymers act to chelate or sequester calcium ions and prevent a calcium rich film from acting as a passivator. They also compete with carbonate for the calcium ions, allowing the carbonate ions to freely associate with the zinc-galvanized coating. The advanced polymers act as crystal modifiers to most passivator films, leaving a more porous film on the zinc-galvanized surface.

Molybdates are not fully able to inhibit white rust.



TREATMENT APPROACHES

- Removal of White Rust
- Repair of the zinc-galvanized coating
- Passivation process
- Erosion control
- Interference
- Treatment adjuncts
- Treatments



White Rust Removal

Mechanical or chemical removal of white rust deposits is the necessary first step in treatment. Chemical removal may be achieved with the application of a mild inhibitive acid.

Repair of zinc-galvanic coating:

The repair of highly impaired surfaces is paramount to maintaining the integrity of the cooling tower. Localized corrosion cells attack the ferrous metal substrate quickly. Corroded ferrous surfaces should be treated with a rust convertor coating to arrest the ferrous corrosion. The convertor coatings, upon drying and curing are ready to accept a zinc-galvanized treatment.

Zinc-galvanized treatments are available in liquid bulk and aerosol formulations. These brush-on or spray-on zinc-galvanized treatments are the equivalent to the hot dip galvanized process and replace corroded surfaces. They are highly resistant to water and salt concentrations.

Passivation Process

The passivation process is designed to provide inhibitive barrier films that have the capacity to control white rust when the cooling towers are exposed to alkaline water conditions. Specific passivation products are employed that promote this production of the inhibitive layer at the galvanized surface. These are aqueous based products that are fed directly to the cooling system and controlled. Regular cooling water treatments are suspended while this process is implemented.



Erosion Control

Suspended particulate matter in the recirculating tower water acts to erode the zinc-galvanized surfaces. Reduction in concentrations of suspended matter reduces the erosion potentials. Surfactants and/or dispersants are employed as adjuncts to the regular treatment to control these suspended particles for furtherance via bleed-off or mechanical separation.

Interference

Oxidizing biocide treatments have great potential to damage passivated films, when used in high dosages. Selection for biocides should be made around reduction of halogen concentrations.

Treatment Adjuncts

Supplementary additives to existing scale and corrosion control treatments may be used to effect greater corrosion control over zinc-galvanizing. These adjuncts are compatible with most of the modern conventional phosphonate/polymer programs.



Treatments

There are basically two approaches to comprehensive treatment programs:

- i) control of the carbonate ion and pH levels
- ii) control of the zinc-galvanize film directly

The former approach requires the control of pH generally between 7.5 and 8.3. This can be accomplished with a formulation that does not build excessive alkalinity or pH. It can also be accomplished in harder water conditions, by the supplementary feed of an acid control. This approach targets elimination of the conditions that foster the white rust syndrome.

The latter approach relies on formulations that passify zinc-galvanize surfaces under higher alkalinity /pH conditions. This method recognizes that attack of the zinc-galvanize surfaces is on-going, and effects chemical barriers to negate white rust formation.



PRODUCTS AVAILABLE

SX-11

A passivating inhibited acid. Colour coded for visual interpretation.

Rust Coat

A rust convertor coating used on ferrous metal substrates. This is applied when the corrosion from white rust has led to localized corrosion of the underlying ferrous metals. The convertor process halts the on-going ferrous corrosion and lays a protective barrier on the ferrous metal. The surface is then ready to treat with a zinc-galvanize compound.

Instant Zinc

A zinc-galvanizing treatment. Replenishes the film. Applied by aerosol spray for small areas and in liquid bulk form for larger surface areas. Fast drying, quick curing.

New Zinc

An aqueous based film renovator and passivator compound for corroded zinc-galvanized surfaces.

M.S.R.

Mud and silt removal compound. An aqueous based solution designed to assist in the removal of suspended particulates, and subsequent reduction in erosion potentials.

KT # 1215

A passivation adjunct for alkaline recirculating waters.

TRL # 37

A clear, temporary protective coating. Used in shut down and off-season periods to provide a barrier film against moisture and atmospheric corrosion. Easily sprayed or brushed on. Easily removed with mild degreasers or quality coil cleaners.

KT # 813

A pH controlled passivating agent to control carbonate ions attack of zinc-galvanized surfaces.