

Cr-free Thin Organic Coatings technology: Superior corrosion resistance for 55%Al-Zn coated steel

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1. General description

A fresh zinc-coated steel coil surface is prone to oxidation or corrosion when being exposed to humid environments during shipping and/or storage. This type of zinc corrosion is often called, “wet stain” or “storage stain”. Unlike other zinc/zinc alloy-coated steel coils, Galvalume (GVL, 55%Al-Zn) has a high content of Al. Traditionally, a Thin Organic Coating (TOC) loaded with a small amount of chromate(Cr6) inhibitor offers the best anticorrosive performance for GVL and is still in use in steel coil industry. Silane-based and Cr3 passivation products have been evaluated on GVL, but the results are not satisfactory. Recently, we have developed a Cr-free TOC technology which provides excellent anticorrosive performance using silane-based Cr-free passivation. Figure 1 shows the application of our Cr-free TOC product on a continuous galvanizing line (CGL)



(a)



(b)

Figure 1. (a) A Cr-free TOC product (white emulsion) being applied onto fresh GVL sheet with roll-coating method. (b) blue-colored, Cr-free TOC coated GVL coils

2. Cr-free TOC technology

2.1. Mechanism

The Cr-free TOC product is a slightly alkaline (pH 7.5 – 9.0) emulsion. The main components and their corresponding functions of this product are listed in Figure 2.

Component	Main functions
Resins	Quality water-based resins (such as polyurethane) are selected which forms a physical barrier to slow down the penetration of water and water-soluble corrosive species
Corrosion inhibitors	Cr-free, highly effective corrosion inhibitors, passivates the GVL surface and provides “self repairing” effect
Additives	<ul style="list-style-type: none"> - Functional surfactants: to provide excellent application performance - Adhesion promoters: such as silanes to promote adhesion between TOC and GVL substrate

TOC

GVL

}

TOC : 1.0-2.0 μm

PMT: 80-110°C (180-230°F)

Figure 2. Main components of TOC and their corresponding functions

2.2. Product (XAF-221) and lab test results

XAF-221 is a slight alkaline white emulsion, based on advanced water-based resin (pH >8, ~25% solids). It offers excellent corrosion resistance, fingerprint resistance and adhesion to paints/adhesives and other desirable properties.

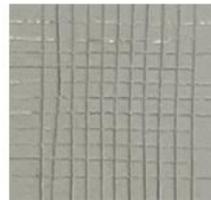
Table 1. Test results for XAF-221-coated GVL sheet

Test items	XAF-221 (film thickness: 1.0 μm)
Corrosion resistance (SST)	No rust after 96 h
Humidity resistance (50°C/95%Rh/120h)	No rust
Fingerprint resistance (Vaseline wipe on and keep for 20 min, and wipe off)	No residual stain
Coefficient of friction, μ_k	0.10
Boiling water resistance	No stain or no film damage
Adhesion	Crosshatch: no paint delamination
	Reversed impact: $\geq 6\text{J}$
	2T bending: no crack

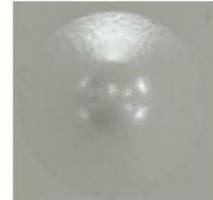


200-hr SST, no rust

(a)



Crosshatch: 5B;



Impact: 6J (no crack)



2T bend: no crack

(b)

Figure 3. Performance test results for XAF-221 coated GVL sheet; (a) 200 h SST (no rust), (b) paint adhesion (no delamination, no cracking)

Also, XAF-221 can be colored and used in the construction industry, as shown in Figure 4.



Figure 4. golden-colored Cr-free TOC-coated GVL used for steel building construction.