

Waterborne Rust Stabilizing Surface Treatment for Weathering Steel “CUPTEN COAT™ AQUA”†

1. Introduction

All of the rust-stabilizing surface treatment now used in weathering steel are organic solventborne coatings, and most are resin-based¹⁾. The volatile organic compounds (VOC) contained in organic solventborne coatings generate suspended particulate matter (SPM) and photochemical oxidants. Measures must therefore be taken to reduce the emissions of VOC²⁾.

JFE Steel has succeeded in commercially producing the world’s first waterborne rust-stabilizing coating. The coating is called CUPTEN COAT™ AQUA^{3,4)}. The features and performance of CUPTEN COAT™ AQUA are described below.

2. Features of CUPTEN COAT™ AQUA

CUPTEN COAT™ AQUA uses a waterborne resin as the matrix resin in the coating to suppress the emissions of VOC. The coating shares two important features with CUPTEN COAT™ and CUPTEN COAT™ M⁵⁻⁷⁾, JFE Steel’s well proven rust-stabilizing treatments with organic solventborne resin: first, CUPTEN COAT™ AQUA uses an anionic type resin to suppress the penetration of Cl⁻ under the coating it forms; second, it is a porous film to allow appropriate levels of H₂O and O₂ to permeate through the coating. CUPTEN COAT™ AQUA also

provides the following functions and features:

- (1) Excellent environmental harmony: harmony with the surrounding environment for many years (the suppression of rust outflow maintains the landscape)
- (2) Rust-stabilizing function under the coating: a dense, continuous layer of rust forms under the coating
- (3) No Cr or Pb compounds contained in the coating
- (4) Treatment possible with only one layer (a single coating)

Figure 1 shows the mechanism by which CUPTEN COAT™ AQUA suppresses rust outflow and stabilizes rust.

The color tones of CUPTEN COAT™ AQUA are adjusted to the original rust colors of weathering steel to avoid mottling when the coating wears away. CUPTEN COAT™ AQUA can be applied by the same treatment methods used to apply conventional organic solventborne coatings, including spray coating.

3. Performance of CUPTEN COAT™ AQUA

An extended exposure test has been conducted to verify the performance of CUPTEN COAT™ AQUA as a rust-stabilizing surface treatment.

3.1 Suppressing Rust Outflow

A test bridge on the yard of JFE Engineering (in Tsu

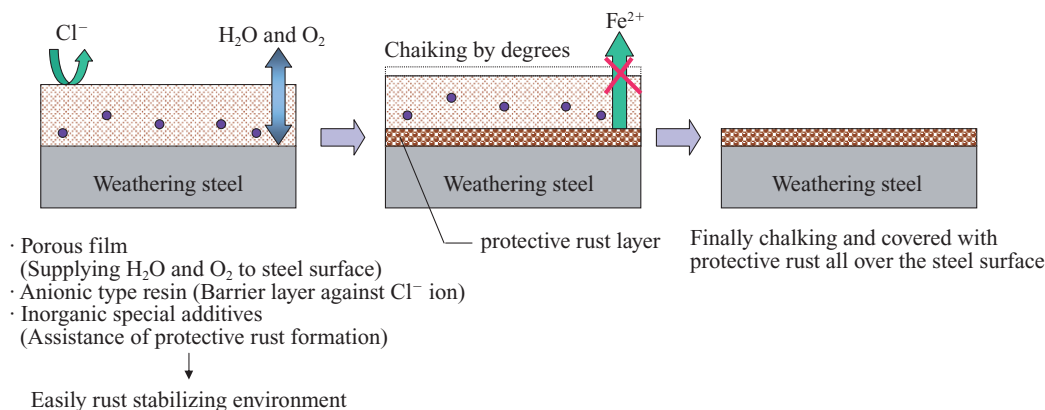


Fig. 1 Rust stabilizing mechanism of CUPTEN COAT™ AQUA

† Originally published in JFE GIHO No. 18 (Nov. 2007), p. 82–83

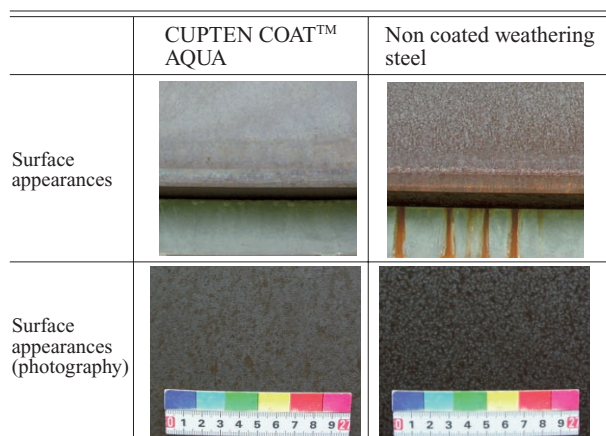


Photo 1 Comparison of surface appearance of weathering steel coated with CUPTEN COAT™ AQUA and non coated weathering steel after 8 year exposure test in coastal area (Tsu City, 0.27 mg · NaCl/dm²/day)

City, Mie Pref.) was coated with CUPTEN COAT™ AQUA. **Photo 1** shows the surface appearance of the bridge eight years after the coating was applied. Rust overflow is observed on the surface of the non-coated weathering steel, whereas no rust overflow is observed on the surface of treated with CUPTEN COAT™ AQUA. The coating remains on the steel surface in the area coated with the rust-stabilizing surface treatment, and no local corrosion is observed. Thus, the treated area exhibits a good appearance with scarcely any mottling.

3.2 Rust-Stabilizing Surface Treatment Function under the Coating

Photo 2 shows the result of an observation of a cross section of the coated area under a polarization microscope. The generated rust is dense, but no rusting from any part of the steel surface is observed under the CUPTEN COAT™ AQUA film. The formation of a continuous and highly protective rust layer on the steel surface can be expected in the future.

4. Concluding Remark

As described above, CUPTEN COAT™ AQUA is a

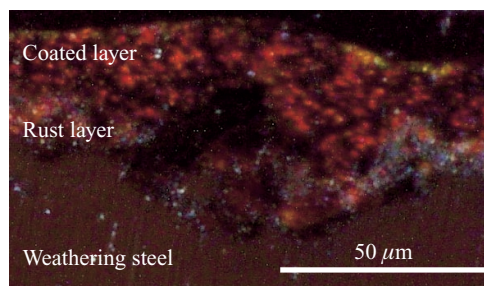


Photo 2 Cross section for weathering steel coated with CUPTEN COAT™ AQUA after 8 years exposure test in coastal area (Tsu City, 0.27 mg · NaCl/dm²/day)

waterborne coating capable of suppressing the emission of VOC. Once applied, it has functions to sufficiently suppress rust outflow in coastal areas.

After CUPTEN COAT™ AQUA is applied once, there is no need for reapplication. Therefore CUPTEN COAT™ AQUA is likely to contribute to the design and construction of environmentally friendly steel bridges and steel structures as a rust-stabilizing surface treatment for weathering steel.

References

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