CORROSION

ALUMINIUM/ZINC COATING ON STEEL

TECHNICAL BULLETIN CTB-6

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COATING STRUCTURE

ZINCALUME® zinc/aluminium alloy coated steel consists of a steel substrate coated on both sides with a zinc/aluminium alloy. The alloy coating is applied in a hot dipping process.

The alloy composition is approximately 55% aluminium, 1.5% silicon and the balance zinc.

A typical microstructure of the alloy coated steel is shown in cross section in Figure 1. The structure which forms on cooling is essentially two phase, comprising about 80% by volume of an aluminium rich phase and the remainder a zinc rich phase with a thin intermetallic layer next to the steel substrate.

Figure 1: ZINCALUME® Steel Microstructure

CORROSION PERFORMANCE OF ZINCALUME® STEEL COATING

When the coating corrodes initially the zinc rich phase corrodes preferentially until the formation of corrosion products reduces further activity in these areas. As there is a smaller area of zinc exposed compared to a galvanized coating, the overall corrosion rate is correspondingly lower. During the initial stage of corrosion the coating behaves like a zinc coating. In the latter stages of corrosion when the coating is essentially comprised of zinc corrosion products carried in an aluminium rich matrix, the corrosion becomes more characteristic of the aluminium rich phase, resulting in a lower corrosion rate, more typical of aluminium.

Results of atmospheric corrosion rate testing together with field history obtained from rural, marine and industrial outdoor exposure sites have shown that ZINCALUME® steel can be expected to provide between two to four times the comparable life of a galvanized coating of equal thickness under the same exposure conditions. Figure 2.

Figure 2: Corrosion Rates of Galvanized Steel and 55% Al-Zn Alloy Coated Steel at Australian Atmosphere Exposure Test Sites.

Site	Galvanized Steel		55% Al-Zn Alloy Coated Steel	
	g/m2/y	um/y	g/m2/y	um/y
Severe Marine	140	9.8	16	2.2
Marine	18	1.3	4.0	0.54
Industrial/Marine	20	1.4	4.2	0.57
Rural	4	0.28	1.3	0.17

g/m² - two sided um - one side

BLUESCOPE STEEL

GALVANIC PROTECTION OF STEEL BY ZINCALUME® STEEL COATINGS

It is natural, with the wide spread use of ZINCALUME® steel sheet in traditional zinc-coated building applications, that the question of comparative cut edge performance should be raised.

Unpainted ZINCALUME® steel will perform in a very similar manner at the cut edge to zinc-coated sheet in the relatively narrow range of thicknesses associated with roofing, wall cladding, gutters and downpipes.

Prepainted ZINCALUME® steel, which may be supplied in thicknesses greater than 1.2 mm, may be subject to corrosion mechanisms at the cut edge. This occurs as a result of the increased ratio of exposed steel to metallic coating at the ZINCALUME® steel sheet cut edge.

To illustrate the comparative benefits of sacrificial protection, a series of grooves ranging from 0.4 mm to 4.0 mm in width was cut through the coatings down to the base metal of both galvanized and ZINCALUME® steel samples. The samples we re-exposed for 12 months in an aggressive industrial/marine atmosphere.

The following photographs of the samples with similar coating thicknesses illustrate the lack of base corrosion, especially in the narrower channels. The latter correspond to thicknesses used for roofing and guttering and other rainwater goods applications.

Figure 3: ZINCALUME® AZ150 sample.

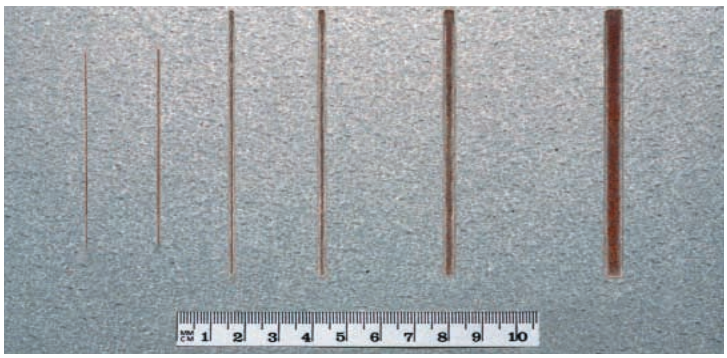

Figure 4: Zinc-coated sample, Z275.

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