PASSIVATION OF ZINC ELECTROPLATED FROM CYANIDE FREE BATH ON MILD STEEL

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The durability of passivation in zinc electroplating had been studied using weak acid zinc bath free from cyanide and ammonia for zinc plating on mild steel, and yellow, rainbow and colorless passivating solutions for passivation process. At the running voltage of 1.1V, current density 4 A/dm^2, pH 5-5.4, and at room temperature, best plating results were obtained from the zinc bath.

After zinc plating, samples were divided into four classes, class 1 preserved as such without passivation while the other classes were passivated in different colored and colorless chromate solutions.

It was found that yellow film was developed when the zinc plated samples, class 4, were dipped in a bath comprising CrO_3 40-60 g/L, H_2SO_4 0.8-1.0 ml/L and HNO_3 3-4 ml/L for one minute and at room temperature. It took 204 hours for the generation of red rust, figure 1, at optimum thickness of zinc layer, 17 microns, in salt spray test, table 1. The thin and colorless film was developed when zinc plated mild steel samples, class 2, were dipped in a bath comprising CrO_3 3-5 g/L, KF 4-5 g/L and HNO_3 2-4 ml/L at the passivating time of 2-3 seconds. It showed only 132 hours for the generation of red rust, figure 1, at optimum thickness in salt spray test. The rainbow film formed when the samples, class 3, were dipped in a bath containing CrO_3 20-30 g/L, H_2SO_4 1-1.5 ml/L, HNO_3 5-6 ml/L for 20 minutes. In case of rainbow passivation the rusting hours was very close to that of yellow passivation; almost 192 hours for the generation of red rust, figure 1, at the optimum thickness of zinc plating. It was observed that the white corrosion product of zinc was not generated by a salt spray test of 60, 84, 108 hours for colorless, rainbow and yellow chromate films respectively, figure 2.

Results showed that yellow passivation had maximum corrosion resistance as compared to rainbow and colorless passivations.

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Table 1: Testing conditions of salt spray test

Parameter	Variation during test
Density of sodium chloride solution, w/v %	4.0 to 6.0
pH	6.5 to 7.2
Compressed air pressure, kgf/cm^2	1.00 ± 0.01
Quantity of spray, ml/80 cm^2/h	1.0 to 2.0
Temperature of air saturator, ^{o}C	47 ± 1
Temperature of salt tank, ^{o}C	35 ± 1
Temperature of test room, ^{o}C	35 ± 1

Initial density of sodium chloride solution, w/v % 4 and pH 6.5

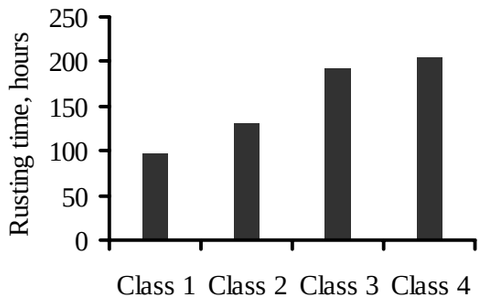

Figure 1: Red rust resistance of different chromate- treated and without chromate-treated zinc plated mild steel samples

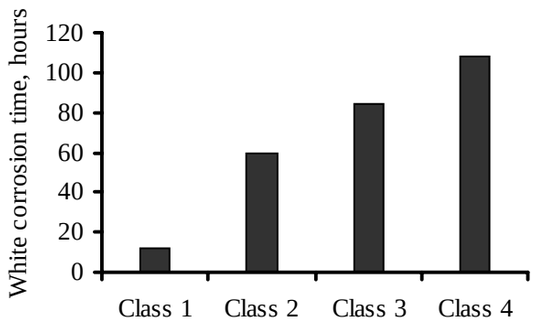

Figure 2: White corrosion resistance of different chromate-treated and without chromate- treated zinc plated mild steel samples