Effect of annealing atmosphere dew point on electrophoretic corrosion resistance of DH hot-dip galvanized materials

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Abstract The selective oxidation of alloying elements in the strip can be caused by the change of dewpoint in the reducing atmosphere during annealing, and the wettability of zinc liquid on the strip surface can be affected, resulting in poor quality of inhibiting layer on the strip surface. Previous studies focused on the effect of dew point on selective oxidation of alloys and plating ability of coatings, but had little effect on corrosion resistance of subsequent electrophoretic coatings. Therefore, this paper focuses on the effect of dew point in annealing atmosphere on corrosion resistance of electrophoretic coatings. In this study, DH780+Z materials with dew points of -40℃, -53℃ and -55℃ in the heating section were selected. At high dew point, Mn elements were enriched on the strip surface, and Mn oxides were uniformly distributed on the strip surface, while at low dew point, Al oxides were on the surface, and the oxides gathered at the grain boundaries. Because the oxides of Mn can react with Al in the zinc solution, the oxides of Mn will not affect the growth of the inhibitory layer, while the oxides of Al will hinder the alloying reaction of Fe and Al, resulting in poor quality of the inhibitory layer. In terms of coating morphology, the coating of high dew point material has an island structure, while the coating of low dew point material is continuous. In the phosphating solution, the coating morphology has little effect on the phosphating performance. The phosphating film morphology, film weight and alkaline resistance of high dew point and low dew point materials are similar. Due to the poor adhesion of the coating caused by the poor inhibition layer, during the salt spray cyclic corrosion test, the corrosion products were easy to spread far away from the joint of the coating and the substrate and the phosphating film at the same time, which accelerated the anodic oxidation of the coating, resulting in a large degree of corrosion diffusion and poor corrosion resistance after electrophoresis. The electrophoretic expansion width of the Sample with high dew point was 3.9mm. The diffusion width of low dew point Sample is 5.9mm. In short, the annealing atmosphere dew point will

affect the adhesion of the coating, and ultimately affect the corrosion resistance of the electrophoretic paint film, so it is necessary to effectively control the annealing atmosphere dew point in the actual production process to avoid poor corrosion resistance caused by poor inhibition layer.

Keywords DH steel, Annealing atmosphere dew point; cathodic electrophoretic coating, Phosphating, Corrosion resistance