

HOT DIP GALVANISING PROCESS.

Hot Dip galvanizing process consists of nails being immersed in the molten Zinc for sufficient time to allow metallurgical reaction between steel surface and molten zinc, resulting in formation of Fe-Zn alloy layer bonding coating to substrate. Most important characteristic of Hot-Dip coatings is the formation of metallurgical bond as a result of reaction between steel and molten Zinc.

There are variations in mechanical means by which product to be galvanized is handled. Just to name a few, nails can be:

- Placed in the basket, submerged into molten Zinc bath, then withdrawn and centrifuged to remove excess zinc and quenched (pic 1).
- Placed in the rotating drum at temperature higher than Zn melting point with Zinc chips: zinc melts and nails react with molten zinc, then nails are quenched in cold water (Pic. 2. Tree Island process)
- Galvanized nails can be dipped into molten zinc more than once (Pic.3 Double dipping)

All processes above result in the metallurgical reaction between steel and molten zinc, which forms Zn-Fe alloy layer. Depending on the processing different types of alloy can be formed. Variations can be achieved in proportion between amount of alloy and pure zinc. Additional annealing is sometimes employed to convert all pure zinc into Zn-Fe alloy. In other cases galvanizing is followed by quick quench to preserve maximum quantity of pure Zinc.

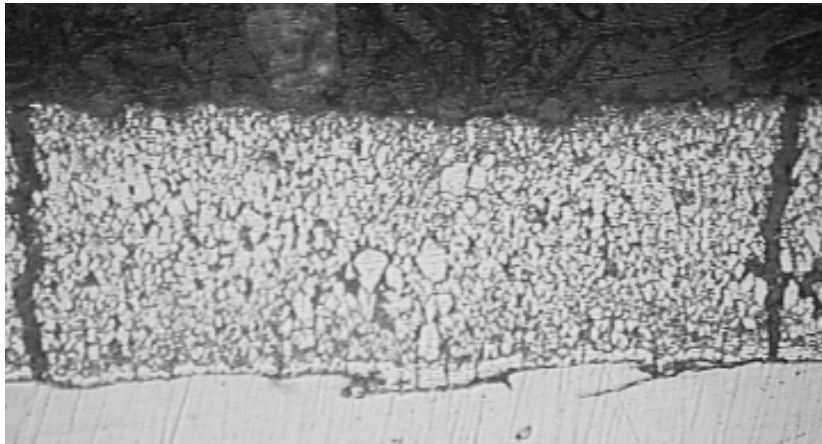
All these modifications result in alteration to coating mechanical properties and/or cosmetic appearance. For example 100% alloy coating is darker in color and is harder than pure Zinc. Coating with higher proportion of Pure Zinc has brighter color and is more ductile. Double dipping process produces distinctively different alloy layers due to prolonged diffusion of Fe into Zn during second dipping. It does not however result in higher coating weight, since first layer partially melts in the process. Tree Island produces coating, which is a combination of good ductility, and abrasion resistance. It consists of bonding layer and pure Zinc outer layer, which is reinforced by evenly distributed Zn-Fe alloy particle.

While appearance and mechanical properties of various HDG coating may be different, they all provide in effect identical level of corrosion protection. This is not unlike steel, which can have different mechanical properties due to heat treatment, but corrosion rate is the same for given steel type. Thus the only parameter which will differ one HDG coating from other in corrosion performance is total Zinc coating weight (pure Zn and all alloy layers).

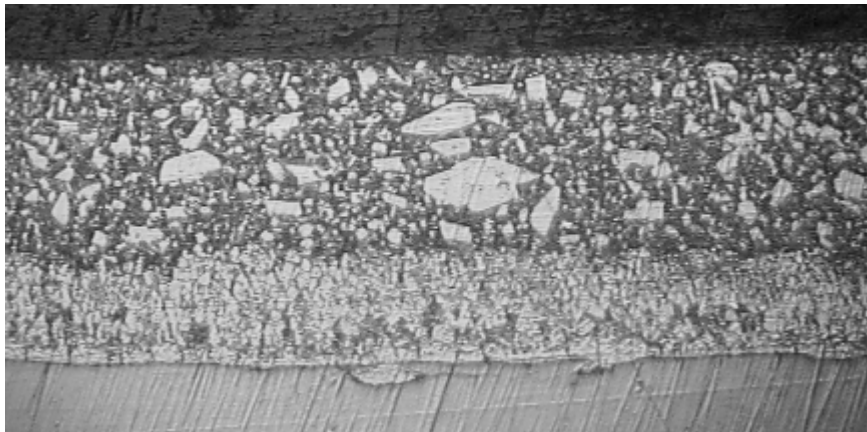
Due to the nature of the process it is very difficult to apply low Zn coating weight. Thus HDG nails are practically guarantee to have at least 1.0 oz/ft² of coating

weight as required by ASTM A153 Cl D. Typical Tree Island Hot Dip Galvanized nails have 1.3 to 1.6 oz/ft²Zinc coating weight.

Pic1 – HDG coating where centrifuging was used to remove excess zinc. Coating consists of 100% Zn-Fe alloy.



Pic 2 – HDG coating applied via rotating hot drum, followed by quench (TII process) coating consist of bonding layer and outer layer and Zn-Fe alloy particles distributed in the pure Zn matrix



Pic 3 – HDG Double dip process. Coating consists of multiple layers of different Zn-Fe alloys. White areas in the outer coating are Zn-Al alloy particles

