

# Hot Dip Galvanized Information Sheet No.1

## Hot Dip Galvanizing versus Zinc Electro-Plating (Electro-Galvanizing)

This information sheet reviews the differences between Hot Dip Galvanizing and that of Zinc Electro-Plating, which is also referred to as “Electro Galvanizing”.

### Zinc Electro-Plating (Electro Galvanizing)

Zinc Electro-Plating is an electrolytic process whereby carbon steel has a thin zinc coating deposited by means of passing an electric current between an anode (zinc) and the carbon steel (cathode). It is analogous to a galvanic cell acting in reverse. The process is shown in the diagram below.

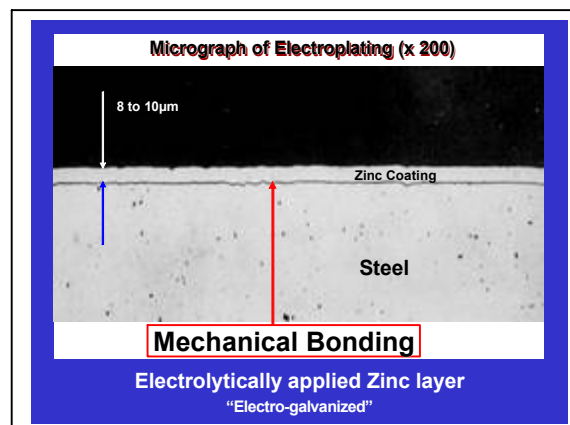
- **Product immersed in a coating solution**
- **DC current passed between the product (cathode) & an electrode (anode)**
- **Coating governed by:**
  - Current
  - Temperature
  - Chemical composition
  - Process time
- **Metals used for electroplating:**
  - Copper
  - Nickel
  - Zinc
  - Chrome

### Electroplating



The characteristics of zinc electro-plating are summarized as follows.

- Uniform smooth coating with a bright luster.
- Coating thickness usually between 6 to 10 microns ( $\mu\text{m}$ ).
- The coating consists of approximately 99% pure zinc.
- Zinc is deposited by means of a cold process.
- The adhesion of the coating to the steel consists of “Mechanical Bonding”.
- The process is carried out at normal room temperatures.
- Product profiles can affect the uniformity of the coating due to what is known as the “Faraday Cage effect”.



Micrograph of typical  
Zinc Electro-Plated  
Carbon steel

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### Hot Dip Galvanizing

As the name implies the application of the zinc coating is a hot process whereby cleaned steel is immersed in molten zinc usually at a temperature of between 445°C and 450°C. When perfectly cleaned steel is immersed into molten zinc a metallurgical (chemical) reaction results, forming a thick coating comprising of a series of zinc and / or zinc iron alloy layers. The adhesion of the resultant coating to carbon steel is therefore determined by means of metallurgical laws and forms a chemical bond to the substrate. Chemical bonding is considered to be far superior to that of a mechanical bond.

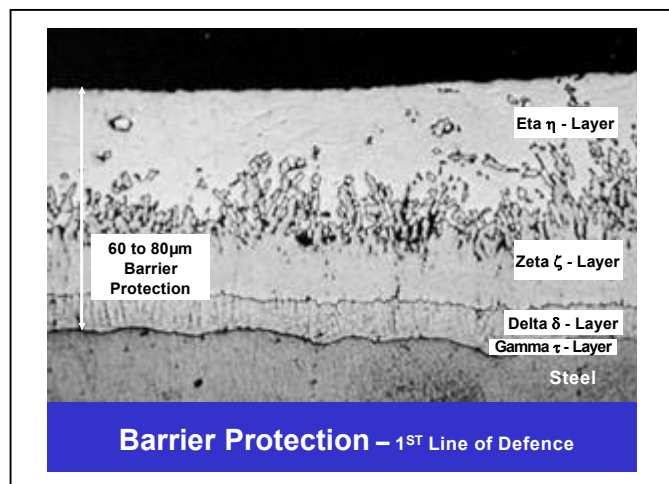
The characteristics of a hot dip galvanized coating are summarized as follows:

- Relatively uniform and can range from a bright silver to a dull grey surface finish depending on the chemical analysis of the steel being processed.
- Coating thickness usually between 55 to >100 microns ( $\mu\text{m}$ ), depending on steel thickness as well as the chemical composition of the carbon steel being processed.
- The coating consists of a series of zinc and / or zinc iron layers, the formation of which is influenced by the chemical composition of the steel being processed.



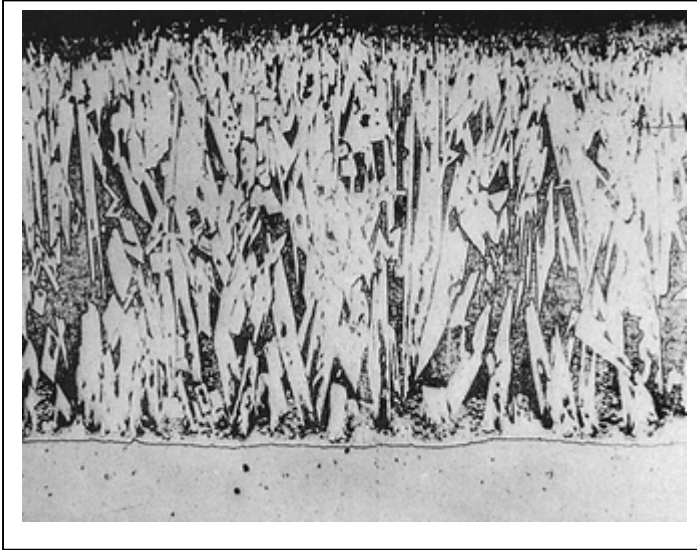
Hot Dip Galvanizing Process and factors that affect coating thickness

Micrograph (x200) of a typical Hot Dip Galvanized coating on "Aluminum Killed Steel".



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Micrograph (x200) of a typical hot dip galvanized coating on "silicon killed" carbon steel within the silicon range of 0.15% to 0.25%. Coating thicknesses range between 100 $\mu$ m to 150 $\mu$ m

Note: The metallurgical reaction between molten zinc and carbon steel is a function of the silicon and phosphorous content of the steel being processed. Refer to information sheets 4 and 14 for details.

### **Corrosion Control**

Corrosion control provided by a zinc coating, in a given environment, is generally a function of the coating thickness, i.e. the thicker the zinc coating the longer the service life of the carbon steel component. It therefore follows that a hot dip galvanized coating, by virtue of its thickness, will provide greater corrosion control when compared to that of a zinc electro-plated component. This factor is illustrated by the fact that in most cases zinc electro-plated components are generally <10 $\mu$ m, whereas hot dip galvanized coatings normally range between 55 $\mu$ m to more than 100 $\mu$ m.