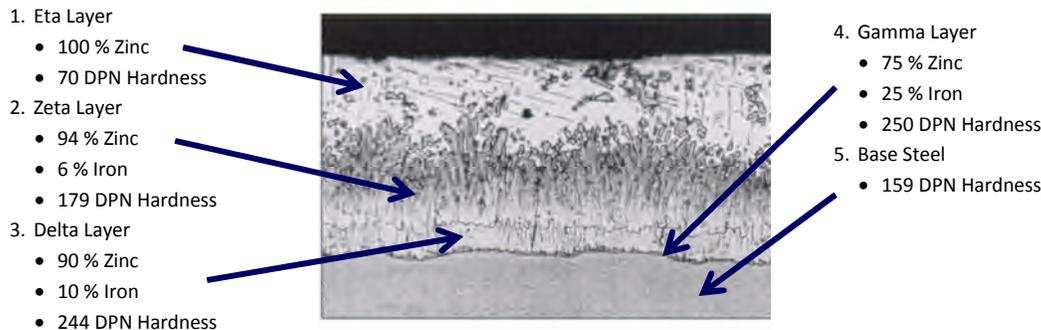


QUESTION

Why are there color variations in galvanized coatings?

ANSWER

In a normal hot-dip galvanized coating, Iron from the base steel and molten Zinc react to form a series of intermetallic alloy layers that are metallurgically bonded to the base steel. The approximate composition of these alloys is shown below:



In contrast to this normal four layer series, the Eta layer can be very thin or even nonexistent when reactive steels are galvanized. Without this layer of free Zinc, the usually smooth silver colored surface will instead display various shades of gray. This is because the underlying Zeta layer continues to grow outward as large crystals, using up the ‘free Zinc’ outer layer in the process. The appearance of the material may change to an even darker gray when the Eta layer is missing from the coating and the exposed Zeta layer begins to weather.

The most significant trace elements in structural steel that influence the character of the galvanized coating layers are Silicon and Phosphorus. Higher concentrations of these elements can accelerate the galvanizing reaction and can lead to thicker and discolored coatings. Because of this property, steels of this type are referred to as ‘reactive steels.’ They foster the unrestrained growth of coarse Zeta layer crystals and aid the diffusion of iron from the underlying layers outward. As a consequence, if reactive steels are galvanized using standard procedures, a thicker matte gray coating can result, without the normal silvery luster associated with the free Zinc Eta outer layer.

The following recommendations should be taken into consideration to minimize the probability of color variations:

- Specify the use of Aluminum killed or rimmed steel when possible. If that is not practical, steel of the same type should be used for a given fabrication.
- Design vent and drain holes that promote rapid immersion into the kettle and rapid drainage of entrapped molten Zinc after dipping. ASTM A385 provides design guidelines which, if followed, will improve the probability of getting consistent quality galvanized coatings.
- Specify that the material be quenched and not air cooled, immediately upon removal from the kettle.

While these color variations may not be aesthetically pleasing, they in no way diminish the primary function of the coating – **Protect the base metal from corroding.**

Available for download at <http://www.metalplate.com/faqs/discoloration.pdf>