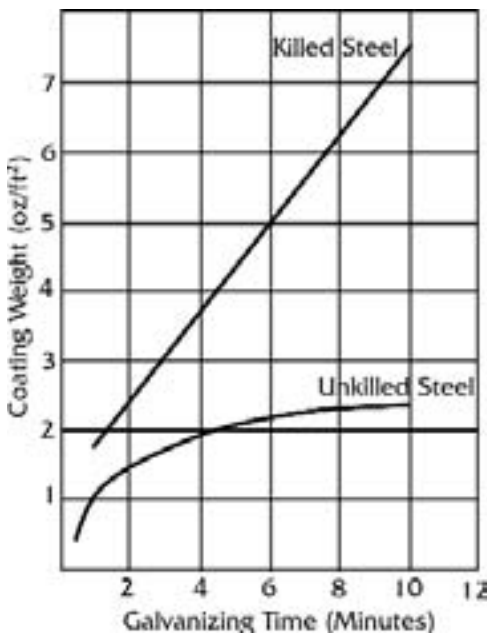


ASK DR. GALV

Q I just galvanized a load of handrail. The parts came in very smooth, as the fabricator took extra care to make sure all of the welds were ground smooth. But, when I finished the galvanizing, the welds looked like big “speed bumps” on the surface. What happened and what do I do about it?

A The hot-dip galvanized coating is formed by the interdiffusion of the zinc from the galvanizing bath and iron from the steel or weld material. One of the major contributing factors in galvanized coating growth is the amount of silicon present in the steel or weld material. Amounts less than 0.04% are considered low silicon, amounts between 0.15 and 0.25% silicon are considered moderate silicon, and amounts between 0.05 and 0.15% and amounts over 0.25% are considered high silicon. When the steel or weld material contains high silicon levels, the hot-dip galvanizing reaction continues to proceed in a linear relationship, as shown in the figure, below. When the steel or weld material contains low or moderate silicon levels, the hot-dip galvanizing reaction tapers off after the coating reaches a certain thickness, as seen in the lower curve:



Killed steel represents the HDG coating growth with high silicon levels in the steel or the weld material. Unkilled steel represents the galvanized coating growth with low or moderate silicon levels. As you can see on the chart, if the parts are left in the kettle for five minutes, a typical

galvanizing time for handrail, the coating weight for low or moderate silicon containing steel is 2.0 oz/sq ft and this corresponds to a thickness of 3.4 mils of coating or 85 microns of coating. If the parts contain high silicon levels and are left in the kettle for five minutes, the coating weight is 4.25 oz/sq ft and

this corresponds to a thickness of 7.0 mils of coating or 180 microns of coating. The high silicon steel has more than twice the coating thickness as the low or moderate silicon steel when immersed at the same time.

Back to the handrail question . . . The fabricator has assembled the handrail with a weld material that contains high silicon levels. This material will form a much thicker galvanized coating than the tubing on either side of the weld. The fabricator probably took a significant amount of time and effort to make sure the weld areas were ground smooth because the part would be used for handrail. It will be very disappointing to him to see, after galvanizing, that the weld now looks like a “speed bump” on the otherwise smooth handrail. The problem can be avoided if the fabricator uses weld rod materials that are compatible with the silicon levels of the tube steel used in the handrail. The AGA website has information on the proper weld rod materials to use before hot-dip galvanizing at <http://www.galvanizeit.org/content/index.cfm?fuseaction=showContent&contentID=168&navID=210>.

The picture below shows three different steel materials. The low silicon material shows a bright and shiny coating, the high silicon pipe material shows a dull grey look, and the high silicon weld material shows the look of a “speed bump” on the part. This is not what the customer expected just looking at the “before galvanized” steel part. The silicon level differences cause this change in appearance and coating thickness, not the galvanizing process.



If the problem already exists, some galvanizers have tried to strip the coating off the handrail and re-galvanize the parts. This meets with limited success. Sometimes the silicon in the weld material near the surface is reduced enough that the second time it is coated the coating does not cause a bump appearance. Most of the time the problem just reappears on the part after the second galvanizing operation. A different solution that many find the least expensive is to grind down the thick coating in the weld areas so the handrail is smooth all around; this may make the appearance of the handrail less desirable. After a year of aging, the appearance difference will be significantly less noticeable. The last resort may be to remake the handrail with the properly matched weld material.