

How does hot-dip galvanizing affect steel strength?

WHY GALVANIZE?

Hot dip galvanized coatings are applied to steel to improve the anti-corrosion performance of the steel to ensure that it lasts as long as possible with a minimum of maintenance

COATINGS DIFFER

Only hot-dip galvanizing gives a coating that can reach the 50 year life required of structural building products.

THICKNESS COUNTS

Compared to other zinc-rich coatings, hot-dipped galvanizing is:-

- THICKER
- HARDER
- FULLER

HOT-DIP GALVANIZED
PRODUCTS LAST
LONGER...



Transfer station with 250MPa & 350MPa hot-dip galvanized components in the structure & 450MPa hot-dipped cold formed sections in conveyor galleries.

Over the past 10 years steel makers worldwide have developed new structural grade steels with higher yield and tensile strengths. These developments have enabled manufacturers to design their steel products using lighter-section steels which in turn reduce the production, transport and erection costs of the finished product. Prior to these developments, the steel fabrications which were most commonly galvanized were manufactured from Grade 250 MPa hot rolled structural steels.

Since the early 1970's, the results from research and testing centres around the world have shown that the hot dip galvanizing process does not affect the tensile and proof (yield) strengths of the Grade 250 MPa structural steels. But does the hot dip galvanizing process affect the yield and tensile strengths of the newer high-tensile grades of structural steels?

Galvanizers have been asked these questions on a number of occasions following claims made by others that galvanizing of these

To ensure that factual information was available, the industry has undertaken a number of testing programs to verify the effects of hot dip galvanizing on steels with yield strengths up to 500 MPa.

Objective

During the hot-dip galvanizing process, steel is dipped in molten zinc at a temperature of 455°C. The aim of these test programs was to establish what effect standard hot-dip galvanizing practices have on the strength properties of typical high tensile steels. These practices include duplicating the immersion time of the steel in the molten zinc (this does not exceed 15 minutes under normal conditions) at a temperature of 455°C.

Test 1 Product: HA70T-P hot rolled steel, manufactured by BlueScope steel.

HA70T-P hot rolled steel has a guaranteed minimum yield strength of 450 MPa and a minimum hardness of 70 HRB. The typical yield strength is between 520 to 610 MPa. The typical tensile strength is between 530 to 620 MPa. This steel is normally used in shelving, automotive parts and more recently for purlins.

Procedure: The test procedure involved cutting eleven pieces from a of 3.0mm thick black HA70T-P steel coil. Six of the pieces were hot dip galvanized in accordance with AS 4680-1999.

Results: Averaging of the results of the yield strengths of the uncoated sections and the results for the galvanized sections of the HA70T-P indicated a difference of 0.4%. As this variation is less than 1% it is considered to be within the accuracy tolerance of the sampling and testing procedures.

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TRIED & PROVEN

Over 40 years of field testing shows that galvanized coatings perform well even in harsh environments.

DOES HOT-DIP GALVANIZING AFFECT STEEL STRENGTH?

The tests carried out showed that hot dip galvanizing has no effect on the mechanical properties of standard grades of steel.

WHY GALVANIZE WITH INDUSTRIAL GALVANIZERS?

For steel users requiring fast, proven corrosion protection for local or national projects Industrial Galvanizers is the established hot dip galvanizer with nationwide coverage.

Test 2 Product: Galvaspan G450 zinc coated, structural grade manufactured by BlueScope Steel.

GALVSPAN G450 has a guaranteed minimum yield strength of 450 MPa and is an in-line hot dip zinc coated structural grade steel. The typical yield strength is between 470 to 550 MPa. The typical tensile strength is between 510 to 600 MPa. This steel is normally roll formed into products such as purlins, girts and light structural profiles.

Procedure: The test procedure involved cutting six pieces from a single length of a roll-formed Z25024 purlin, which had been roll formed by BHP Building Products. The steel thickness was 2.4 mm. Three of the pieces were acid pickled (to completely remove the Z350 mill applied zinc coating) and hot dip galvanized in accordance with AS 4680-1999. The remaining pieces were left in the mill applied Z350 Zinc coating (as rolled) finish.

Results: Averaging of the results of the yield strengths of the uncoated sections and the results for the galvanized sections of the Galvaspan G450 indicated a difference is 0.6%. As this variation is less than 1% it is considered to be within the tolerance of the sampling and testing procedures.

Test 3 Product: OneSteel Grade 500 Plus (Microalloyed and Tempcore) reinforcing bar.

OneSteel Grade 500 PLUS reinforcing bar is manufactured in straight lengths using the TEMPCORE process (quenching and tempering) and in coil for using micro-alloying of the steel. This product has a guaranteed minimum yield strength of 500 MPa. All steel reinforcing products are designed to be bent in accordance with relevant design codes for concrete construction.

Procedure: Samples from a number of different steel heats, in sizes of 12, 24 and 36 mm diameter with both Tempcore and micro-alloyed chemistry were tested, with samples galvanized in both straight lengths and after bending. Control samples from each batch were tested in conjunction with the galvanized samples.

Results: Averaging the results of the OneSteel 500Plus reinforcing bar yield strengths indicated a small increase in yield strength from 592 MPa to 602 MPa or 1.45%, after galvanizing the reinforcing bar. This variation is within the acceptance limits for this product.

These tests verify that hot dip galvanizing has no effect on the mechanical properties of standard grades of steel. This is consistent with principles associated with steel metallurgy as the temperatures involved in the galvanizing process are well below the transition range for structural steels.

All sections were tested at BHP Port Kembla Technical Services for testing.

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