Southwire

Examination of Galvanized VS Bezinal Coated Steel Samples

Distribution
Ridley Thrash

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Methodology: The methodology for evaluating the Galfan/Bezinal (Galfan/Bezinal is a Zinc 5% Aluminum alloy with a mischmetal addition that, when applied as a coating on steel, offers an improvement over the performance of regular or lead-free galvanized steel.) VS the Conventional galvanized steel will consists of the following: Samples of lengths of approximately 3.5' will be used for analysis. Wrap tests will be performed *per ASTM spec B 606.*

Heat Treatment: The samples will be divided into several sample classifications each classification being subjected to a specific degree of heat (see Tables I and II for a description of the sample classification).

- Samples will be pulled after soak times of 6, 10 and 14 hours
- Samples will then be pulled at intervals of 24 hours through a one week cycle
- Following this samples will be pulled at regular intervals of a week through at least four weeks. Finally samples will be pulled at intervals of a month. It is important to note that data will be compiled and analyzed concurrent with the times the samples are being pulled and therefore the cycle times and the total length of time may vary based on the structural data.

Wrap Test Results:

- The wrap test data for the galvanized samples, heat-treated at 200^0 C (see figures III and IV) indicated initial evidence of coating failure after 5 weeks. Note that samples of Bezinal were not subjected to the 200^0 C, heat-treat.
- The wrap test results for the galvanized coated steel samples indicates that the samples that were heat, treated at 215^0 C failed the wrap test after one week of exposure to 215^0 C (see figure V and VI).
- The wrap test results for the galvanized coated steel samples indicates that the samples that were heat, treated at 250^0 C failed the wrap test after 72 hours of soak time (see figure VIII). The Bezinal coated steel samples indicated that the samples after 16 weeks soak time have continued to pass the wrap test, that is, there was no coating failure observed.
- The galvanized coating for the samples heat-treated at 315^0 C (soak times 14 hours) suffered failure even before the wrap test was conducted See figure XI) while the samples that were coated with Bezinal heat-treated at 315^0 C (soak times 14 hours) passed the wrap test. The Bezinal samples continued to pass the wrap test even after 16 weeks of exposure to 315^0 C (see figure XIV).
- The Bezinal coated steel samples indicated that the samples after 16 weeks soak time at 350^0 C have continued to pass the wrap test (see figure XVI), that is, there was no coating failure observed.

The micro-structural evaluation we believe will give us a clearer understanding of the activation energy required for the brittle phase inter metallic we believe is causing the coating failure.

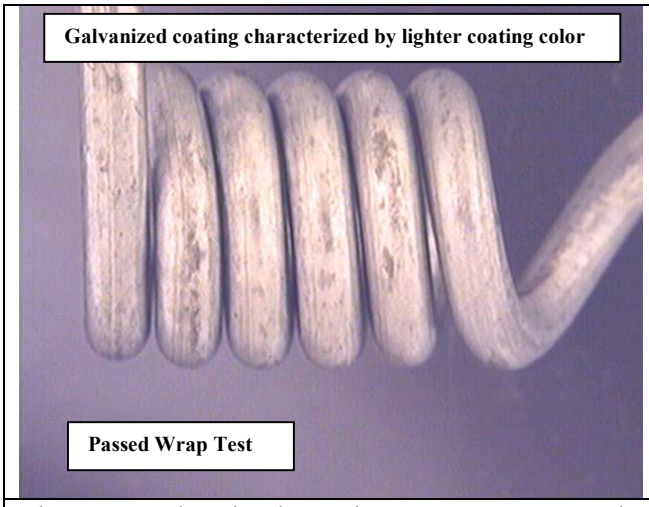


Figure I: Galvanized Coating: Pre Heat treated

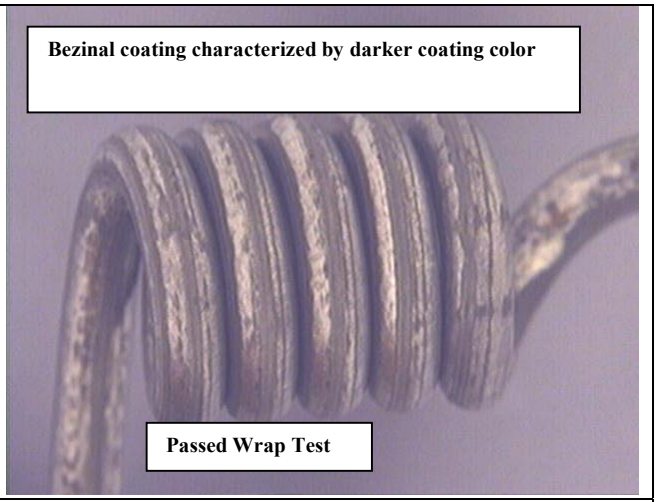


Figure II: Bezinal: Pre Heat Treated

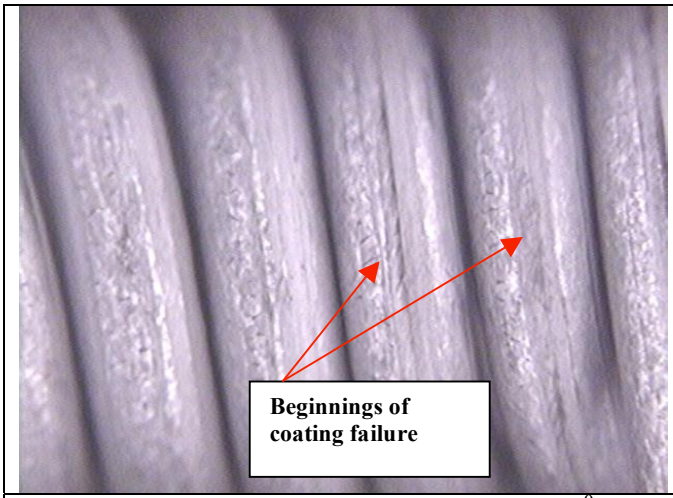


Figure III: Galvanized: Heat Treated at 200^0 C for a soak time of one five weeks.

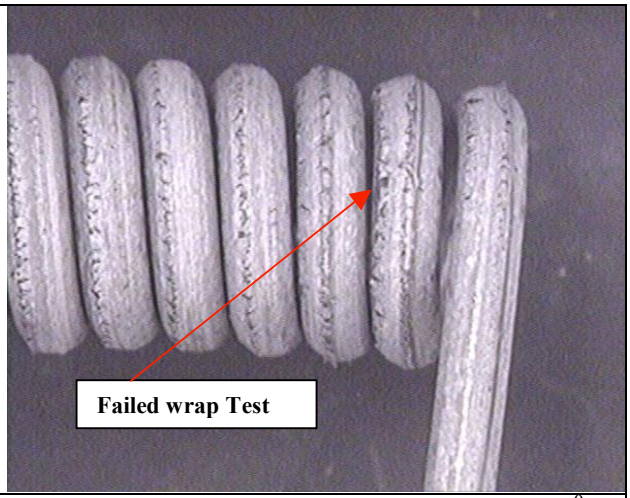


Figure IV: Galvanized: Heat Treated at 200^0 C for a soak time of Seven Weeks.

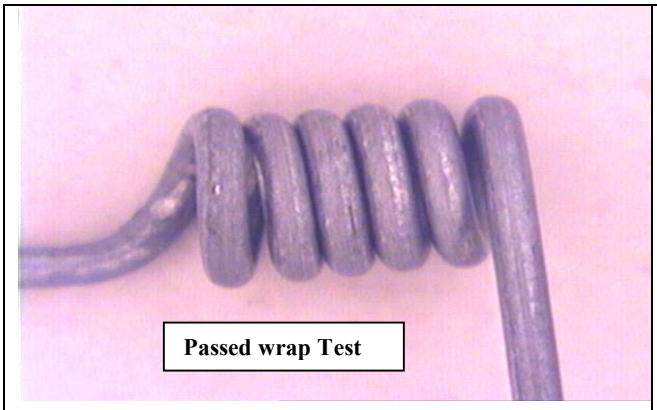


Figure V: Galvanized: Heat Treated at 215^0 C for a soak time of 14 hours.

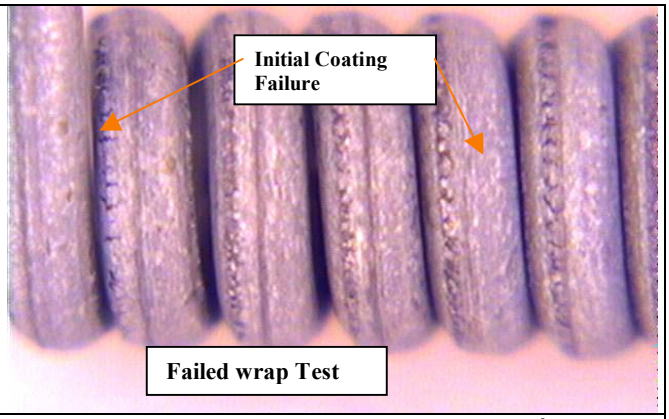
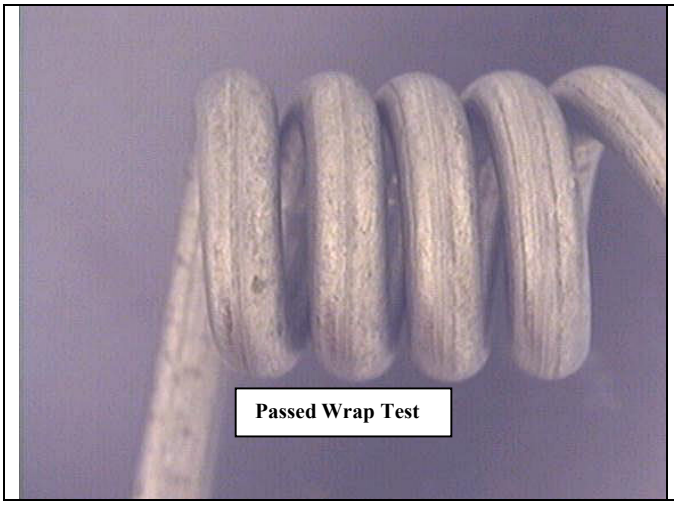


Figure VI: Galvanized: Heat Treated at 215^0 C for a soak time of 1 week.



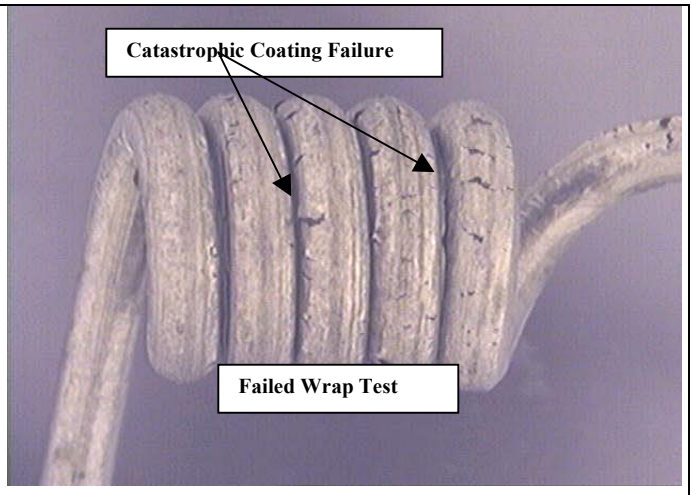


Figure VII: Galvanized: Heat Treated at 250^0 C for a soak time of 48 Hours **(Two days)**	Figure VIII: Galvanized: Heat Treated at 250^0 C for a soak time of 72 Hours **(Three days)**

Figure IX: Bezinal: Heat Treated at 250^0 C for a soak time of 6 Hours

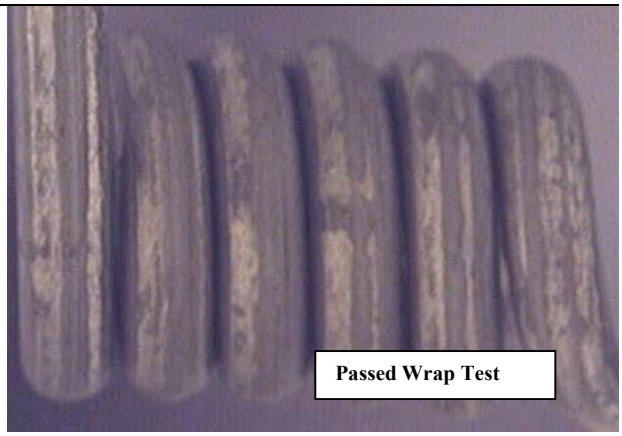
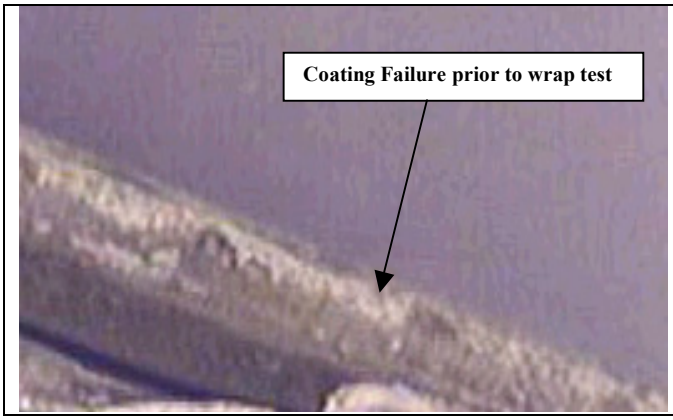


Figure X: Bezinal: Heat Treated at 250^0 C for a soak time of 1 week



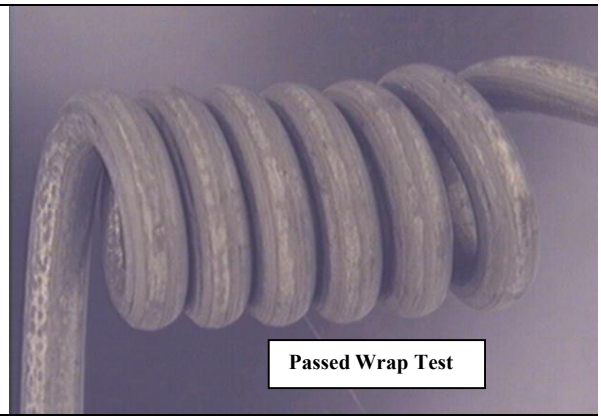


Figure XI: Galvanized: Heat Treated at 315^0 C for a soak time of 14 Hours	Figure XII: Bezinal: Heat Treated at 315^0 C for a soak time of 14 Hours

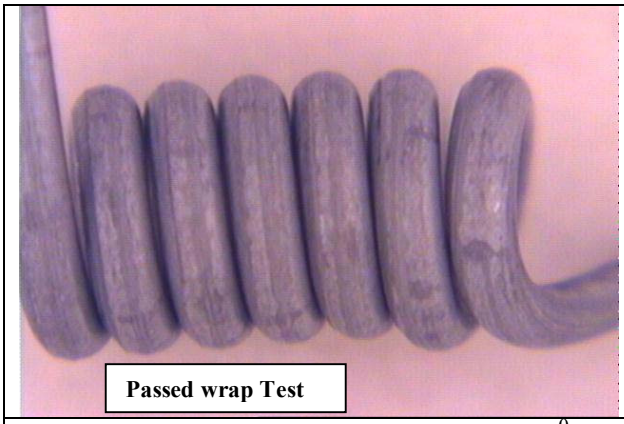


Figure XIII: Bezinal: Heat Treated at 315^0 C for a soak time of 4 weeks.

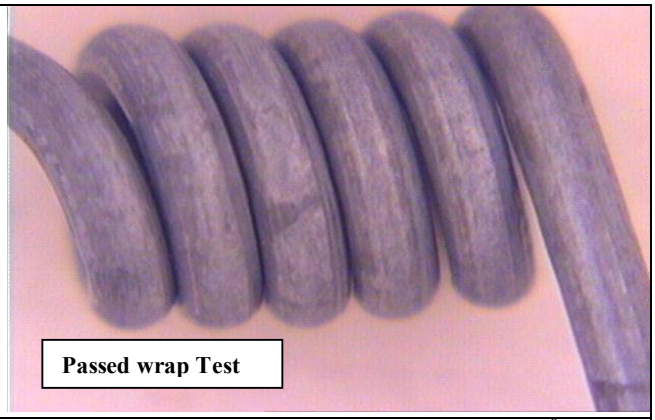


Figure XIV: Bezinal: Heat Treated at 315^0 C for a soak time of 16 weeks.

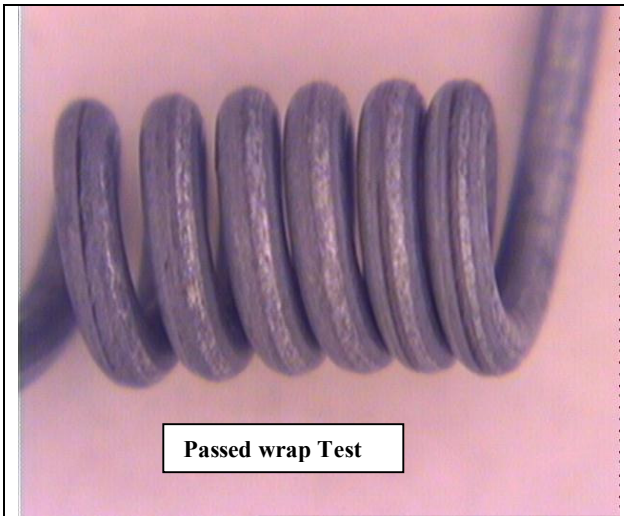


Figure XV: Bezinal: Heat Treated at 350^0 C

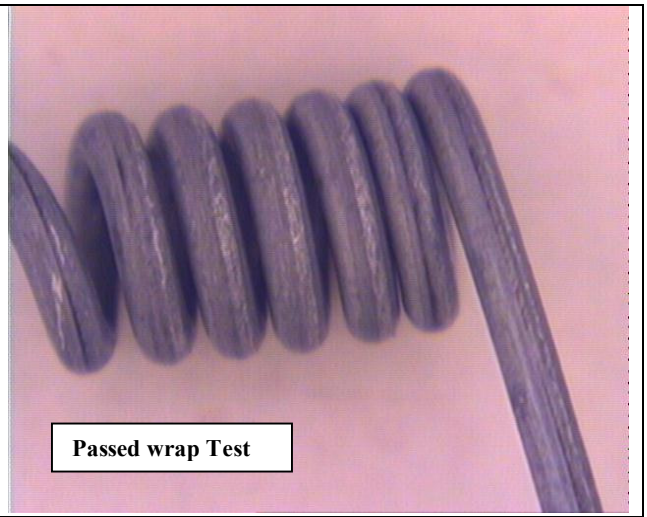


Figure XVI: Bezinal: Heat Treated at 350^0 C

for a soak time of four weeks.	for a soak time of 16 weeks.

Table-I

Temperature	200^{0}C[1]		215^{0}C[1]		250^{0}C[1]		315^{0}C[1]	
Galvanized Coating	Time[2]	Wrap Test	Time	Wrap Test	Time	Wrap Test	Time	Wrap[3] Test
Galvanized Coating	6 hrs	Pass	6 hrs	Pass	6 hrs	Pass	---	Fail
Galvanized Coating	10 hrs	Pass	10 hrs	Pass	10 hrs	Pass		
Galvanized Coating	14 hrs	Pass	14 hrs	Pass	14 hrs	Pass		
Galvanized Coating	1 week	Pass	1 week	Fail	3 Days	Fail		
Galvanized Coating	4 Weeks	Pass						
Galvanized Coating	5 Weeks	Fail						

Table-II

Temperature	250^{0}C[1]		315^{0}C[1]		350^{0}C[1]	
Bezinal Coating	Time[2]	Wrap Test	Time	Wrap Test	Time	Wrap Test
Bezinal Coating	6 hrs	Pass	----	----	----	----
Bezinal Coating	10 hrs	Pass	----	----	----	----
Bezinal Coating	14 hrs	Pass	14 hrs	Pass	14 hrs	Pass
Bezinal Coating	1 week	Pass	1 Week	Pass	1 week	Pass

Bezinal Coating	**4 weeks**	**Pass**	**4 Weeks**	**Pass**	**4 Weeks**	**Pass**
Bezinal Coating	**16 weeks**	**Pass**	**16 weeks**	**Pass**	**16 Weeks**	**Pass**

1. **Temperature the samples were subjected to also set temperature. Note that the oven temperature was $+2^0$ C of the set temperature at all times.**
2. **Soak times**
3. **The coating failed prior to the wrap test**