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LABORATORY ACCREDITATION BUREAU
ACCREDITED ISO/IEC 17025
Certificate # L2267 Testing

Evaluation of NTI HS Film and ActivPak

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Project #:13-074-1125.bis

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ISO 9001 CERTIFIED QUALITY SYSTEM REGISTERED

ENVIRONMENTAL ISO 14001 CERTIFIED SYSTEM REGISTERED

Background: It was requested that the NTI ActivPaks be tested to determine what it is emitting, and if it can stop already existing rust. It was also requested that the NTI HS film be compared to VpCI-126 to determine if it provides sufficient corrosion protection.

Sample Received:

1) NTI HS yellow film, good condition, received 04-10-13
2) 5 NTI ActivPaks, received 04-25-13

Method:

1) VIA Test (CC-027)
2) Razor Blade Test (CC-004)*
3) Nitrite/Nitrate Test*
4) FTIR Test (CC-006)
5) Physical Properties: ASTM D882-02, ASTM D1709-04 Test Method A, ASTM D1922-06A, MIL-STD 3010 TM 2065, and ASTM D1894 (Performed at Cambridge Advanced Film Division)*
6) Packaging Test with Pre-rusted panels*
7) Triazole Test*
8) Nitrite Test*

*Cortec Laboratory is not accredited for the test marked

Materials:

1. VIA Test Kit
2. Laboratory Grade Methanol
3. Carbon Steel Panels
4. Control Film, Plain Polyethylene Film
5. Deionized Water
6. Paragon 1000 FTIR
7. Nitrate/Nitrite Test Strips, EM Quant
8. VpCI-126 4 mil Batch#31957
9. Non-VCI polyethylene bags
10. Pre-rusted steel panels (after 12 hours in ASTM B-117)
11. Nitrite and Triazole Test Kits

Procedure: The tests were performed according to their standard procedures. Results for VpCI-126 were taken from QA random testing results for batch 31957.

Packaging Test:
1. Place 2 pre-rusted steel panels in 2 separate large polyethylene bags.
2. Add an ActivPak to one of the bags.
3. Place both bags in a humidity chamber at 120 ºF and 99% relative humidity for 2 weeks.
4. Photograph the panels before and after test to compare difference in rust.

Results:

Razor Blade Test – Carbon Steel

Sample	Panel 1	Panel 2	Panel 3
NTI HS Yellow Film	Pass	Pass	Pass
VpCI-126	Pass	Pass	Pass
Control	Fail	-	-

Razor Blade Test – Copper

Sample	Panel 1	Panel 2	Panel 3
NTI HS Yellow Film	Pass	Pass	Pass
VpCI-126	Pass	Pass	Pass
Control	Fail	-	-

Physical Properties

Property	Machine Direction/ Transverse Direction	Test Method	Units	NTI HS Yellow Film	VpCI-126
Caliper	-	ASTM D6988	mil	3.91	4.37
Breaking Factor	MD	ASTM D882-02	lbs/in	11.36	17.16
	TD			11.22	16.82
Tensile Strength at Break	MD	ASTM D882-02	psi	2869.40	4028.62
	TD			2955.04	3947.71
Elongation at Break	MD	ASTM D882-02	%	708.54	630.47
	TD			706.20	753.23
Yield Strength	MD	ASTM D882-02	psi	1225.46	1440.49
	TD			1397.76	1202.24
Dart Drop Impact Resistance	-	ASTM D1709-04, Test Method A	grams	572.71	667.86
Puncture Resistance	-	MIL-STD-3010, TM 2065	lbf	4.79	8.09
Tear Strength	MD	ASTM D1922-06A	gram force	553.60	473.60
	TD			560.00	1299.20
Coefficient of Friction	-	ASTM D1894	static	0.26	0.52
	-		kinetic	0.30	0.49

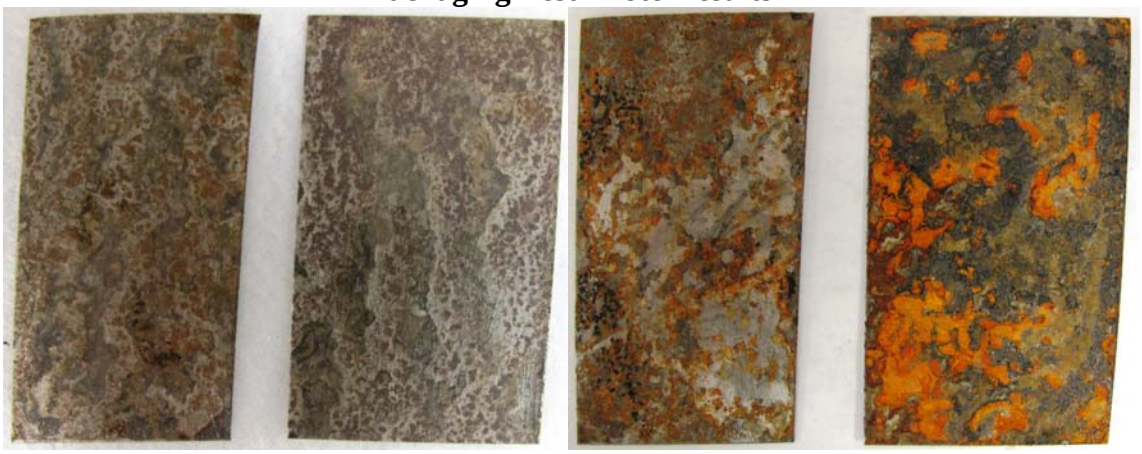
VIA Test

Sample	Plug # 1	Plug # 2	Plug # 3	Pass / Fail
NTI HS Yellow Film	Grade 0	Grade 1	Grade 1	Fail
VpCI-126	Grade 2	Grade 2	Grade 3	Pass
Control	Grade 0	N/A	N/A	Fail

Note: Grades 0 and 1 are considered failing. See below for grading scale example.

Results relate only to the items tested

Packaging Test Photo Results



ActivPak Before	Control Before	ActivPak After	Control After

Interpretations:

1) Based on the test results, the NTI HS Yellow film provides good multi-metal contact phase corrosion inhibition. The VIA tests determined that it does not provide vapor-phase corrosion protection.
2) The NTI HS Yellow film was found to contain nitrite.
3) The physical property testing results determined that VpCI-126 has a greater breaking factor, tensile strength at break, dart drop impact resistance, tear strength (TD), and Coefficient of friction than the NTI HS Yellow Film.
4) The NTI HS Yellow Film has similar results compared to VpCI-126 for elongation at break, and tear strength testing (md).
5) The ActivPak did not stop rust from forming on pre-rusted panels. The results are still better than the control; however, the pouch had absorbed all the water in the bag while the control panel was sitting in significant amounts of water.
6) The ActivPak failed the triazole test and passed the nitrite test. This means the pouch can provide corrosion protection to steel, but not to yellow metals. It should be noted that nitrite is toxic to humans and animals in large enough doses.