4119 White Bear Parkway, St. Paul, MN 55110 USA
Phone (651) 429-1100, Fax (651) 429-1122
Toll Free (800) 4-CORTEC, E-mail info@cortecvci.com
Internet http://www.cortecvci.com

Evaluating VIA Ability and Diffusion Ability of Oil-base VCIs: Cortec VpCI-326, 329, 322 and Mobilarma 247

From: Cortec Corporation Laboratories
4119 White Bear Parkway
St.Paul, MN 55110

cc: Boris Miksic
Anna Vignetti

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Test conducted by:
Ming Shen

Liz Austin

Approved by:
Margarita Kharshan
Laboratory Director

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Background: It was requested that the ability of oil-based VCIs to diffuse in gas phase be investigated. The following products were tested to determine if they could diffuse 50ft and provide corrosion protection for carbon steel: Cortec VpCI-326, 329, 322, and Mobilarma 247. In addition, the VIA ability of the above products was also investigated.

Sample Received: See above

Sample(s) labeled: N/A

Method: 50 Foot Diffusion Test

Materials:

1) Cortec VpCI-326, 329, 322
2) Mobilarma 247
3) Carbon Steel Q Panels
4) Methanol-lab grade
5) 4 sets of 50 ft LDPE tubing with ID of 1”
6) 8 of 10-gal plastic boxes with lid (Sterilite)
7) 5 gal buckets with lid
8) Glycerol, 99+%
9) DI-water

Procedure:

1) Set up 4 sets of box-50ft tubing-box diffusion test apparatus (see Photo -Setup) for each of the four inhibitors.
2) Clean the carbon steel Q-panels with methanol.
3) Place 4 oz of VpCI-326, 329, 322 and Mobilarma 247 in the 1st box (Source Box) of each of the diffusion test apparatus (step 1), respectively. Place 1 cleaned panel in each of the source box (1st box), suspended from lid. Place 3 cleaned carbon steel panels in each of the after-diffusion box (2nd box), suspended from the lid. 3 panels were also placed inside the control container. Close the lids tightly on all containers and let condition for 3 days at ambient temperature (75±5^{o}F).
4) Make VIA solution (3% Glycerol in DI-water).
5) After 3 days, approximately 300 ml of the VIA solution was added to each of the after-diffusion boxes (2nd box), and the control container. Each box was sealed inside a large plastic bag. All test apparatuses and the control were then placed inside a 120^{o}F, 100% RH chamber for 7 days.
6) After 7 days, the panels were examined for corrosion, and photographed for record-keeping.
7) The percentage of corrosion on each panel was calculated and tabulated.

Results:

VIA Ability – Corrosion on Panels in the Source Box
(3 day conditioning at 75±5°F, 7 day humidity exposure at 120°F)

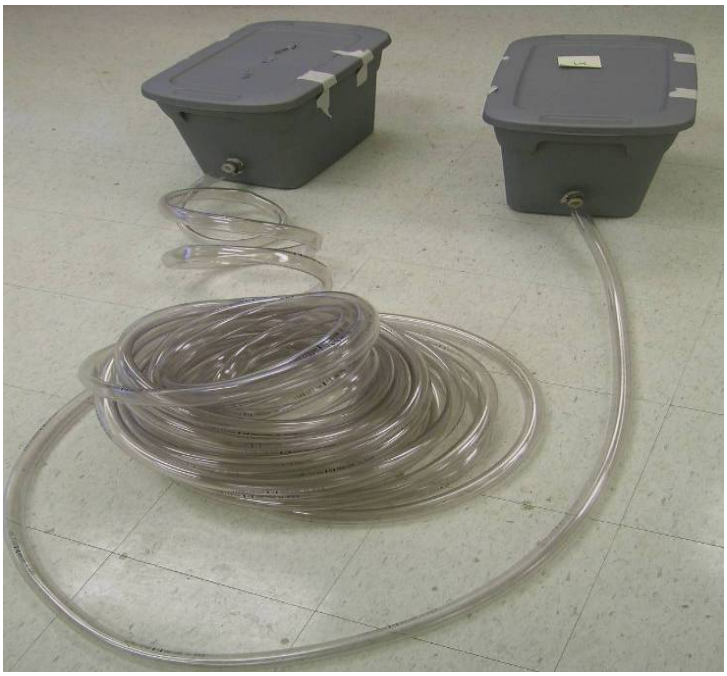
Inhibitor	% of surface corroded
VpCI-326	<1
VpCI-329	<1
VpCI-322	2
Mobilarma 247	30
No Inhibitor (control)	12

Diffusion Ability - Corrosion on Panels in After-50ft-Diffusion Box
(3 day conditioning at 75±5°F, 7 day humidity exposure at 120°F)

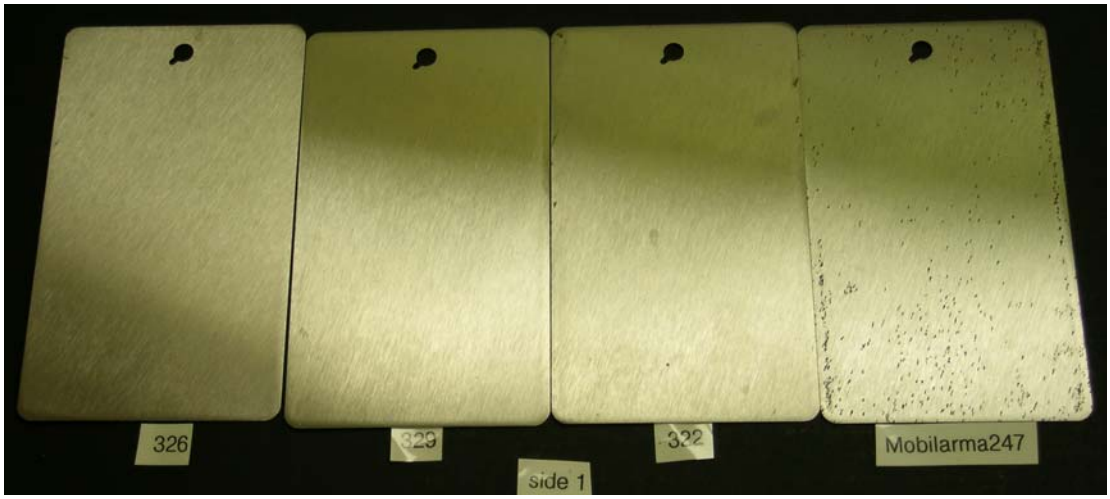
Inhibitor	% of surface corroded
VpCI-326	3
VpCI-329	3
VpCI-322	5
Mobilarma 247	2
No Inhibitor (control)	12

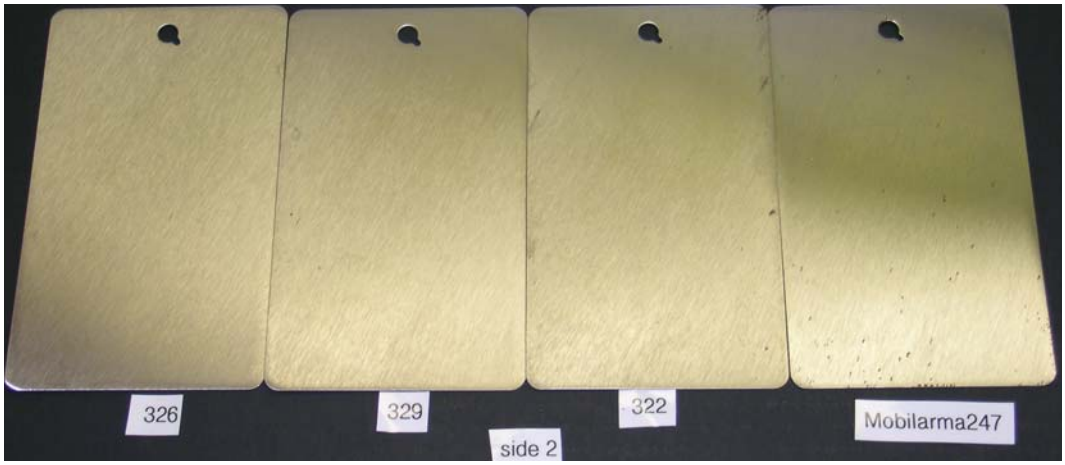
Photos:

Setup of diffusion test apparatus



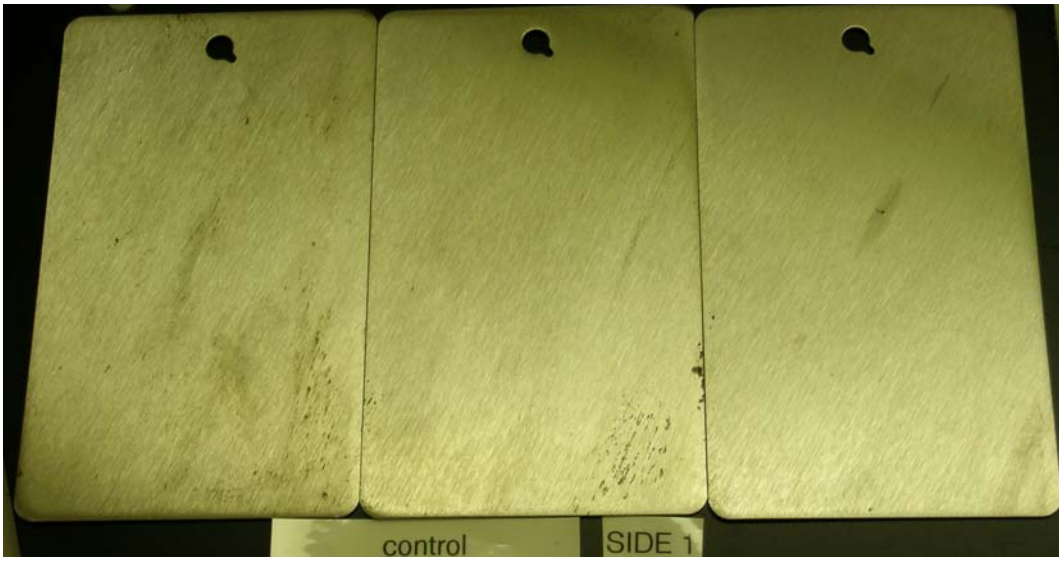
Panels in the Source Boxes (1st Box)

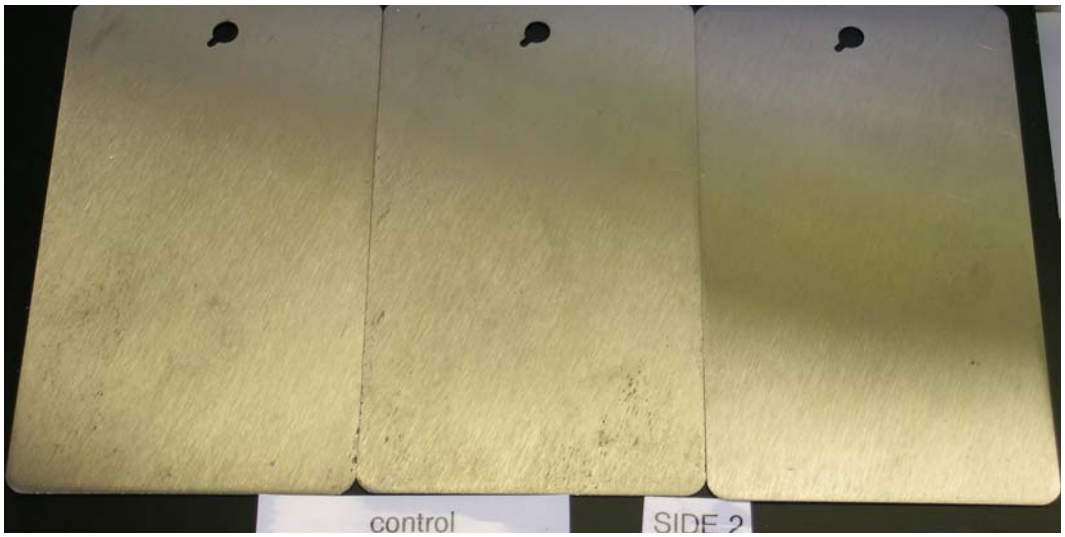




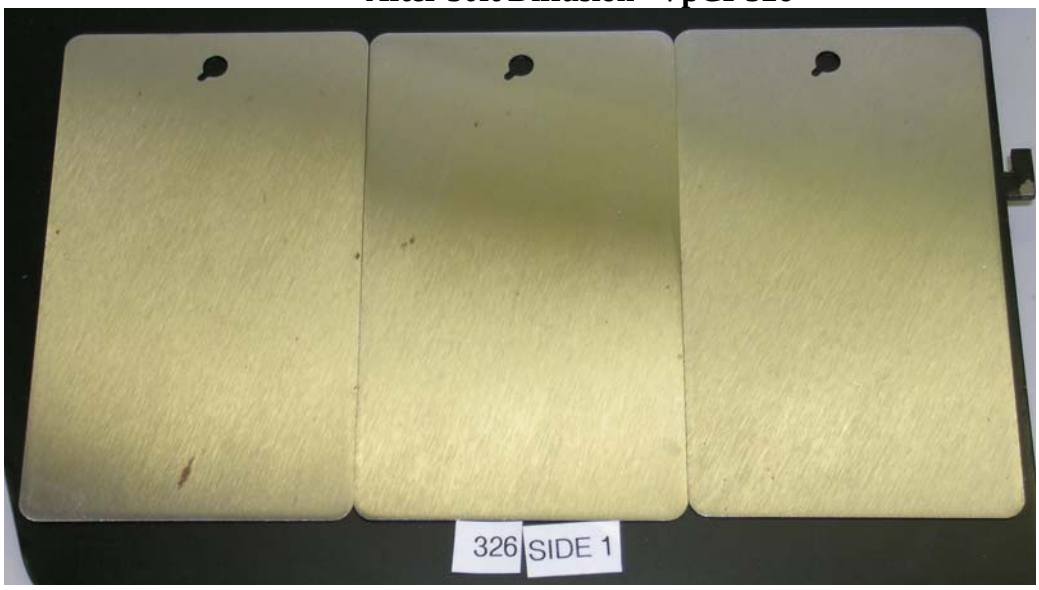
Panels in the After-diffusion Boxes

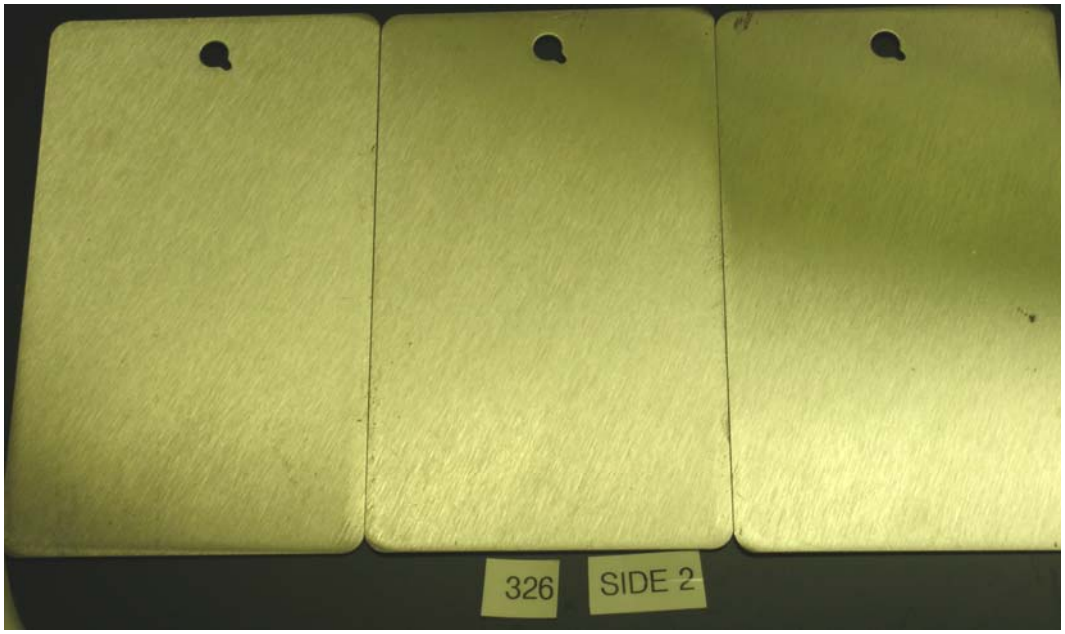
Control



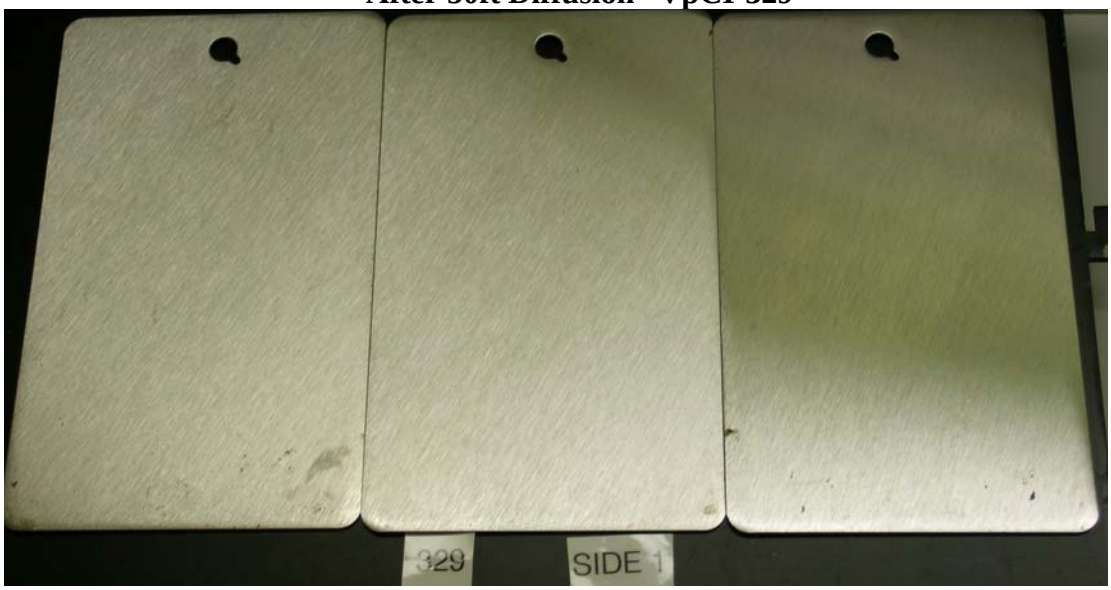


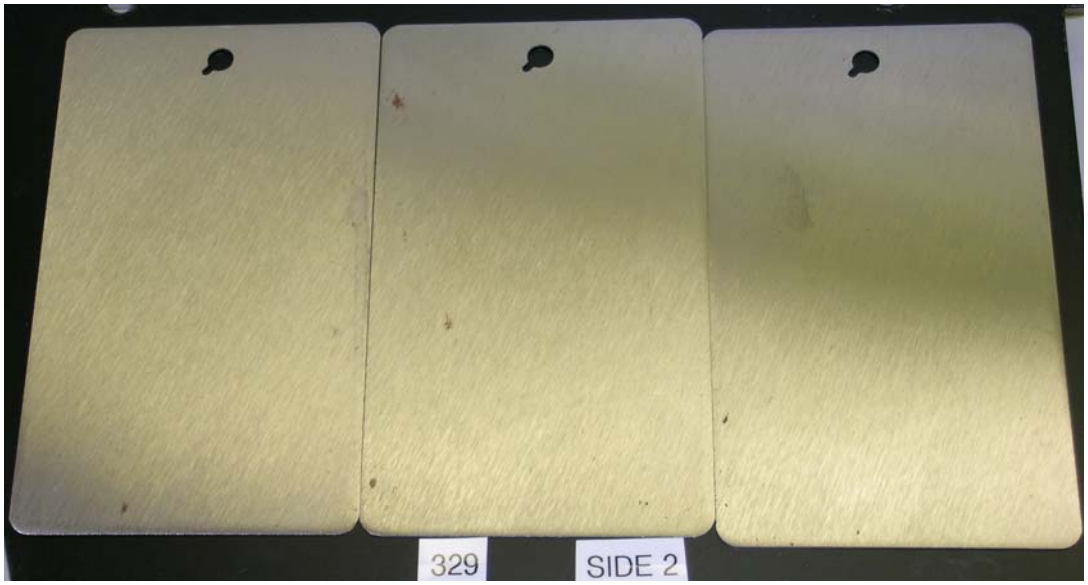
After 50ft Diffusion –VpCI-326



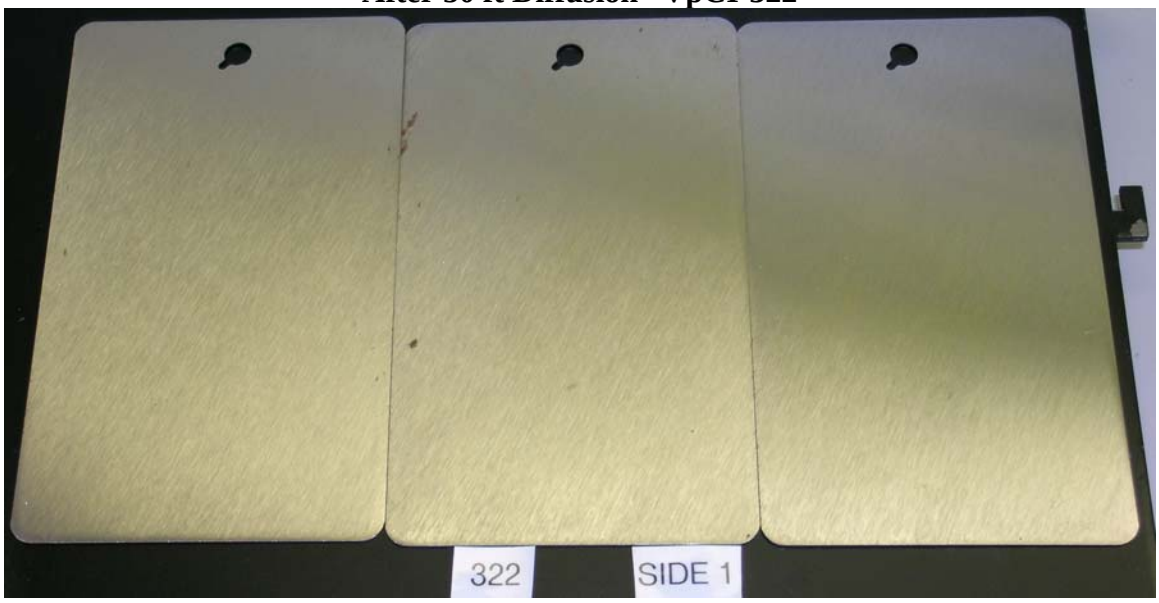


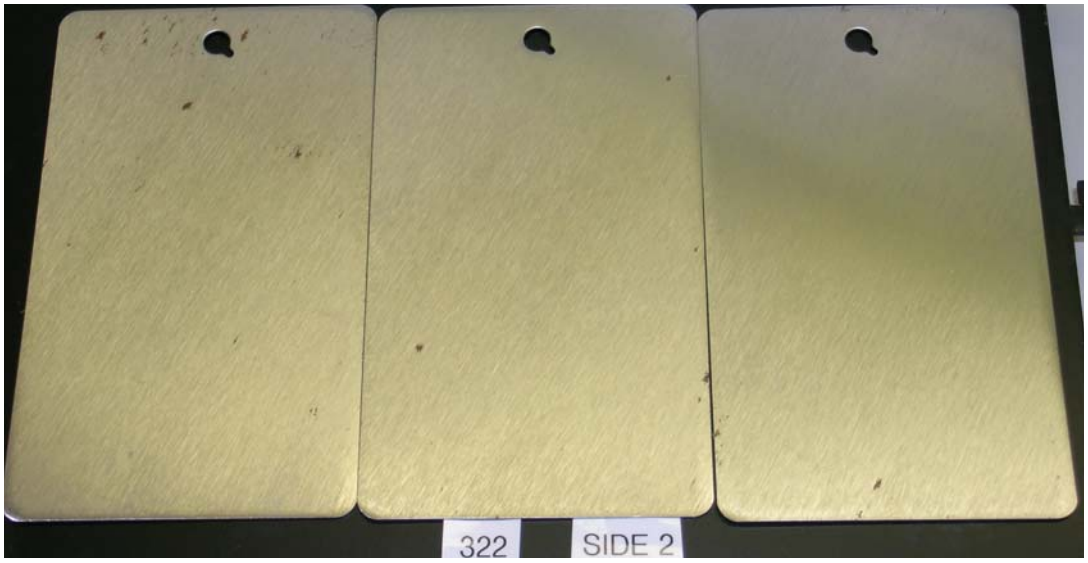
After 50ft Diffusion –VpCI-329



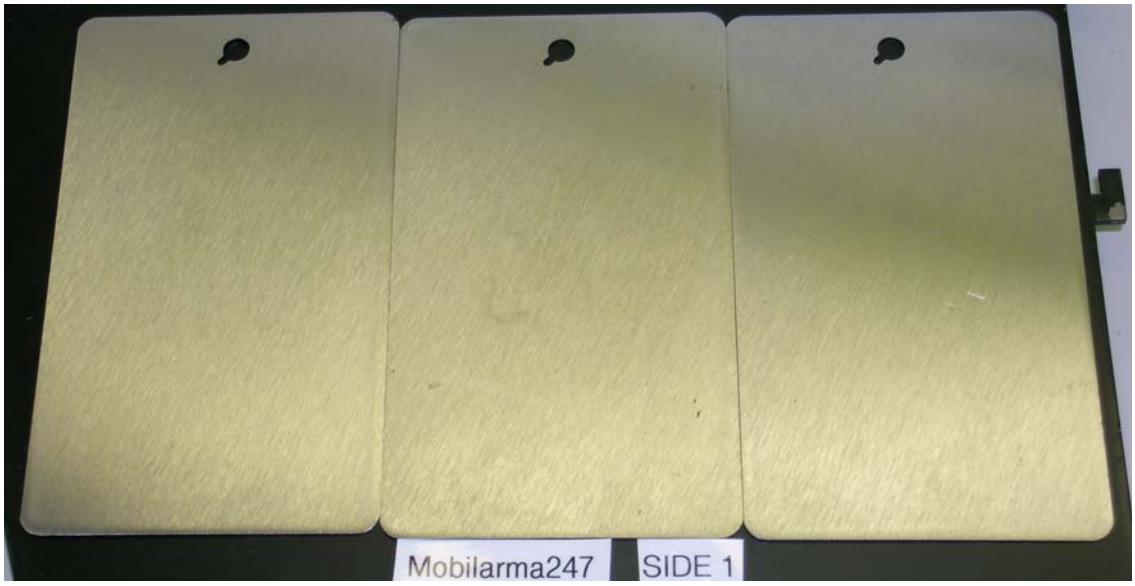


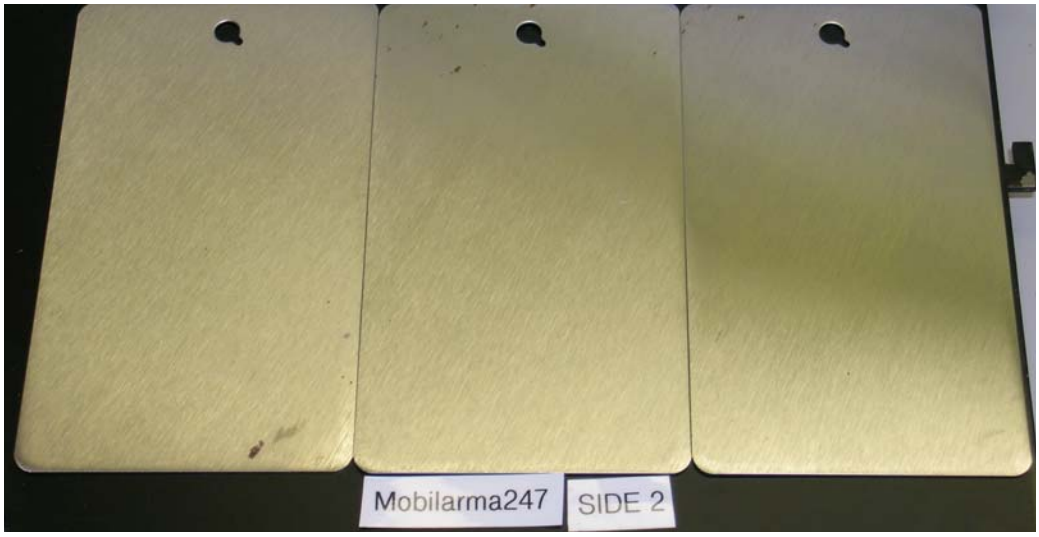
After 50 ft Diffusion –VpCI-322





After 50 ft Diffusion –Mobilarma 247





Interpretations:

The panels from the source boxes (the box that the inhibitor was placed directly into) demonstrated the vapor inhibiting ability of the tested material. Based on the test results, the panels exposed to VpCI-326 and VpCI-329 had the least amount of surface corrosion, with VpCI-322 having just slightly more. The panel exposed to Mobilarma 247 had more surface corrosion than the control, which indicated that it is not a good corrosion inhibitor for carbon steel, and may be corrosive.

There is corrosion, though slight, on all panels placed in the after-50ft-diffusion boxes. Compared to the control, the panels in the after-diffusion boxes containing VpCI-322, VpCI-326, VpCI-329 and Mobilarma 247 showed some improvement,

see Table above, indicating that there are some vapor inhibitors diffused 50ft and provided some corrosion protection.

The results of these tests also make us believe that Mobilarma 247 oil contains a mixture of ingredients with different vapor pressure and corrosion activities. The less volatile compound cause significant corrosion in the first test and this might happen in some industrial applications.