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VpCI-383 Humidity Test

From: Cortec Corporation Laboratories
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Project #:15-071-1525.bis

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Background:

Our customer is trying to revolutionize the conservation industry by utilizing environmentally friendly coatings and preservatives. It is of utmost importance that the coatings not interfere with the appearance significantly because the preserved pieces will ultimately be displayed in museums.

Sample Received:

No Sample Received

Method:

Modified ASTM-1735 (humidity chamber)

Materials:

1) Steel Q-panels
2) Lab Grade Methanol
3) DI water
4) VpCI-383 (B# 03654)
5) VpCI-434 (B# 90035)
6) MiniTest 500 DFT Gauge with a non-ferrous tip

Procedure:

Three experiments were performed throughout this test: a coating appearance test, a humidity test, and a removal test.

Previous experiments with VpCI-383 on copper showed a slight level of tarnish during the drying phase. Once the coating is dry, the surface is protected, and this issue is rarely encountered due to the rarity of applying a clear coating to solid copper surfaces. The coating appearance test was designed to determine the wet film thickness that can be applied to a copper surface without tarnishing it. Five copper panels were glued to a larger steel panel and coated with a gradient thickness of VpCI-383, increasing downwards. Once the first layer was coated and evaluated for tarnish, the next layer was applied much thicker to achieve a smooth, glossy surface and to see if there would be any additional tarnish.

The humidity test proceeded separately from the coating appearance test and was fairly straightforward. Four steel panels (one to be scored) and three copper panels were coated with a very thin layer of VpCI-383 (~.5 DFT, 1-1.5 mil WFT). The edges of these panels were protected by dipping them in paraffin wax. Finally, the panels were placed in ASTM D-1735 conditions (100 °F at 98% rh) alongside control panels and run in the chamber for 1500 hours.

The removal test was done on the panels from the humidity test to determine an easy way to remove the cured coating. This was performed by liberally wetting the coated surface with water, methanol, or acetone and placing a plastic film over the area. If there was no significant change in the coating by the time the surface was dry, the removal method was considered a failure. At the end of the test, a panel was dipped in VpCI-434 and checked every 5 minutes for complete coating removal.

Results:

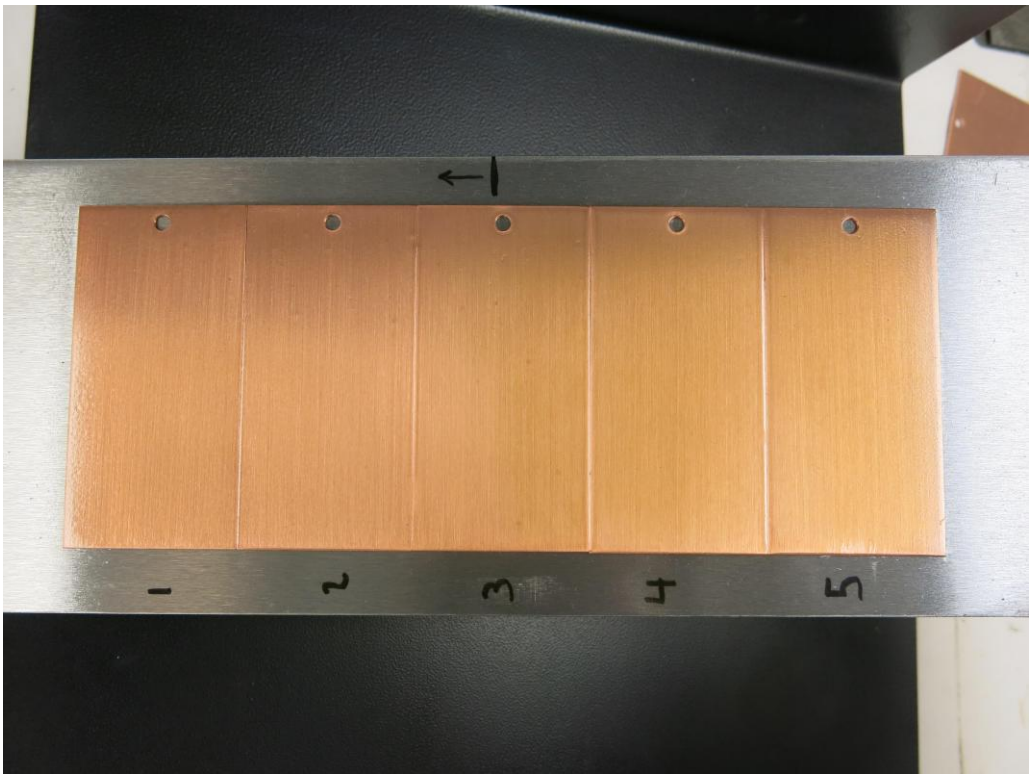
Panel	Average DFT	Tarnish
1	1 mil	none
2	0.8 mil	none
3	1 mil	50%
4	1.5 mil	100%
5	1.3 mil	100%

Table 1: The DFTs from the initial application of the coating appearance experiment. DFT is roughly half of WFT for this coating.

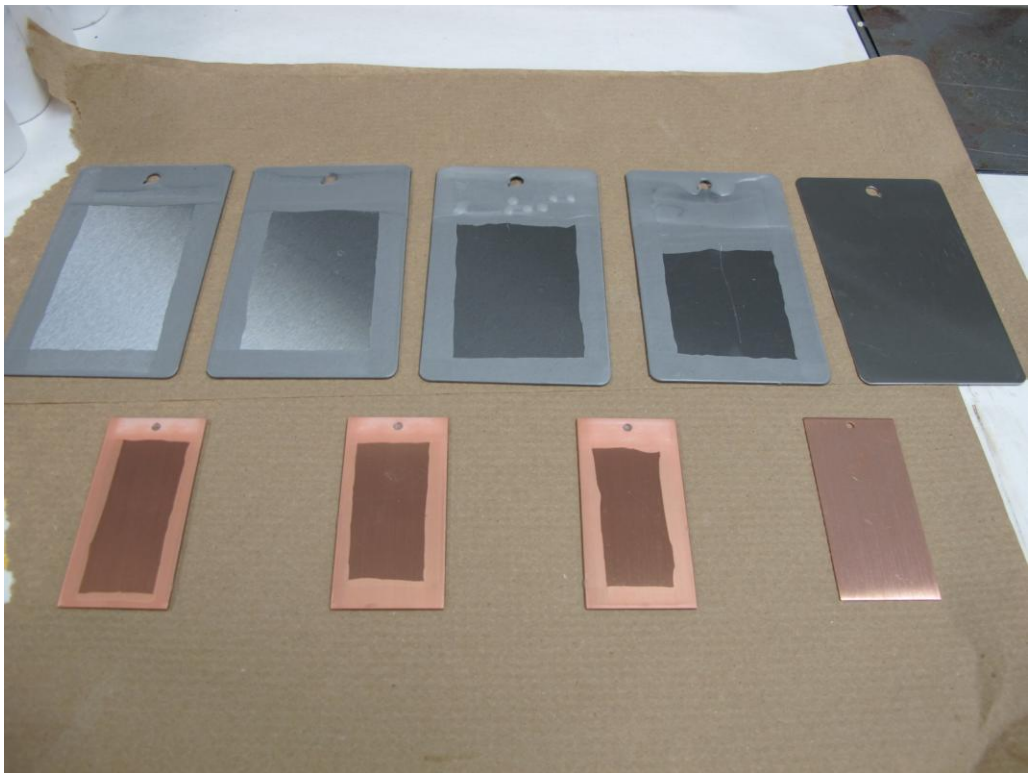
Removal Method	Result
Water	N/A
Methanol	N/A
Acetone	N/A
VpCI-434	10 minutes

Table 2: The methods utilized in attempting to remove the .5 mil DFT films remaining on the surface.

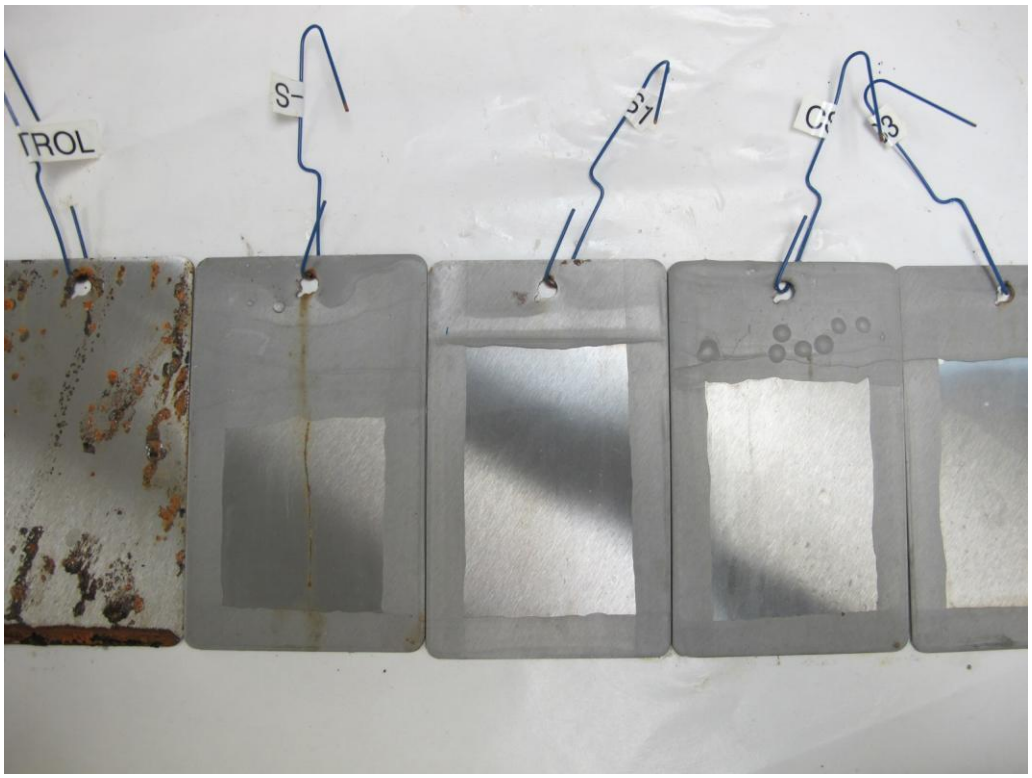
Photos:



Picture 1: This is a picture of the application gradient of the appearance test. There is a slight green discoloration that starts half-way through panel 3.



Picture 2: This is a picture of the coated panels before being placed into the humidity chamber.



Picture 3: The condition of the steel panels after 1500 hours in the humidity chamber. The control is on the left.

Picture 4: The condition of the copper panels after 1500 hours in the humidity chamber. The control is on the left.

Interpretations:

While this product works well on steel without much consideration, the application to copper must proceed carefully to avoid slightly tarnishing the metal, which happens when applied above 2.0 mil WFT. Once this first layer is solid enough, another coat may be applied to achieve the desired final film thickness. Regardless, a thick coating is not necessary to achieve a strong protection for humid environments.

VpCI-383 provides excellent protection in humidity and could easily have gone much longer than the test duration judging from the lack of corrosion or tarnish on any coated surface. Surviving 1500 hours at a .5 mil thickness shows that VpCI-383 can provide a robust protection while still not significantly altering the appearance of the metal.

Removing VpCI-383 with various solvents was expected to fail because the resin used to make the coating, despite being an acrylic, is still very resilient. Since the ultimate DFT of the film was .5 mil, it was capable of being removed within 10 minutes by Cortec's VpCI-434 stripper.