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Evaluation of Zerust Film Samples Compared to VpCI-126 Film

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Background: The customer is currently using Cortec's VpCI-126 bags. However, they order parts from Korea that are packaged in various VCI bags. From there, the customer uses a logistics company to repackage the parts from the shipping container into smaller bins lined with VpCI-126 film. However, the logistics company is not removing the parts from the VCI bags prior to stacking the parts in the bin lined with VpCI-126 film. As a result, the customer is receiving the packaged parts and finding some of the parts with corrosion.

The customer is working with their logistics company to properly package parts in the VpCI-126 film, but would also like to transition their supplier to using VpCI-126 film for overseas packaging. To help their supplier switch to VpCI-126 bags, the customer would like the VCI bags from Korea evaluated for their corrosion protection capabilities.

Sample Received: The following samples were received on 11-2-18 in good condition:

1. Big yellow film bag, 3.5mils
2. Small yellow film bag, 3.5mils
3. Big clear film bag, 2mils

Method:

FTIR Analysis, CC-006
 Razor Blade Test, CC-004*
 NACE Standard VIA Test, TM0208-2008, item No. 21253*
 Nitrite/Nitrate Test*

*The tests marked are not covered under Cortec Laboratories, Inc. ISO 17025 Scope of Accreditation

Materials:

VIA test kit (testing jars/apparatus, steel plugs, 400grit sandpaper)
 VpCI-126 film, 4mil (batch #510220)
 Carbon Steel panels, SAE 1010 (for razor blade testing)
 Copper panels (for razor blade testing)
 Glycerol (lot #Q10A018)
 Nitrite/Nitrate Test Strips (lot #HC719626)
 Methanol, ACS grade (lot #071417B)

Procedure:

For VIA testing, the procedure was followed according to NACE VIA Test, TM0208-2008 option 2 (option 2 uses machine-aided grinding and polishing for the steel plugs).

Note- the VIA tests were conducted using two strips of sample per jar (1" X 6" per strip)

The FTIR analysis and razor blade testing was followed according to standard procedure.

Results:

The following results were found:

Razor Blade Test- Carbon Steel Panels

Sample	Panel #1	Panel #2	Panel #3	End Result
Big yellow film bag	Fail	Fail	Pass	Fail
Small yellow film bag	Pass	Pass	Pass	Pass
Clear film bag	Fail	Fail	Fail	Fail
VpCI-126 Film*	Pass	Pass	Pass	Pass
Control	Fail	-	-	Fail

Results:

The following results were found:

Razor Blade Test- Copper Panels

Sample	Panel #1	Panel #2	Panel #3	End Result
Big yellow film bag	Fail	Fail	Fail	Fail
Small yellow film bag	Fail	Fail	Fail	Fail
Clear film bag	Fail	Fail	Fail	Fail
VpCI-126 Film*	Pass	Pass	Pass	Pass
Control	Fail	-	-	Fail

NACE VIA Test

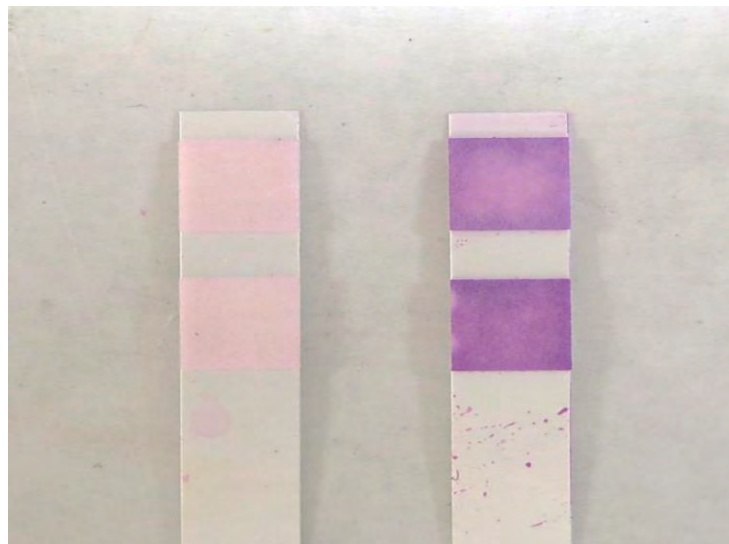
Sample	Plug #1	Plug #2	Plug #3	End Result
Big yellow film bag	Grade 1	Grade 0	Grade 0	Fail
Small yellow film bag	Grade 2	Grade 2	Grade 2	Pass
Clear film bag	Grade 0	Grade 0	Grade 0	Fail
VpCI-126 Film*	Grade 3	Grade 3	Grade 2	Pass
Control	Grade 0	Grade 0	-	Fail

*Note- The results for VpCI-126 film used in this report was previously tested (from 16-083-1125)

Nitrite/Nitrate Test Strips

Sample	Results
Big yellow film bag	Contains low concentration of nitrite/nitrate
Small yellow film bag	Contains high concentration of nitrite/nitrate
Big clear film bag	Does not contain nitrite/nitrate

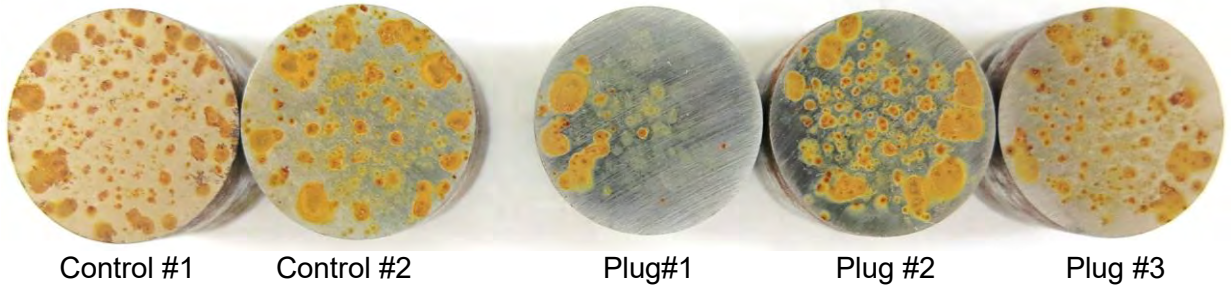
Photo showing the nitrate/nitrate test strip results:



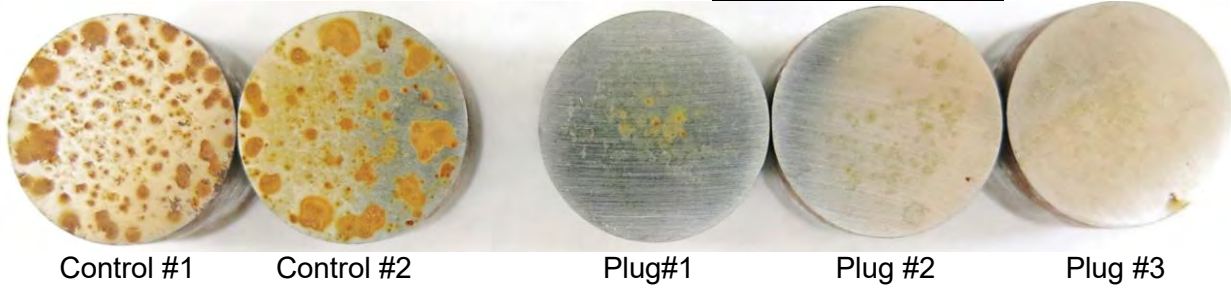
Big yellow film bag (left) Small yellow film bag (right)

Photo from the NACE VIA test:

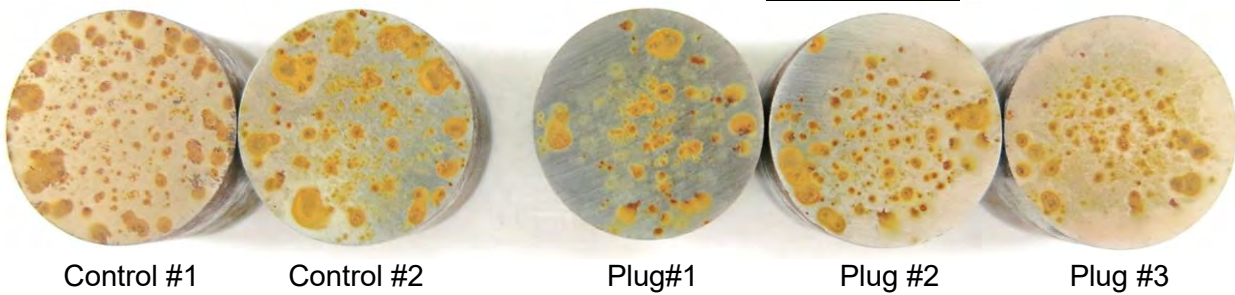
Big Yellow Film Bag



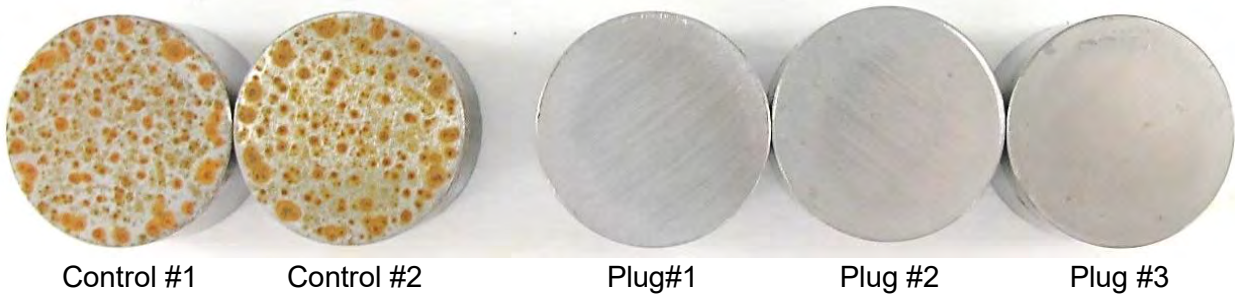
Small Yellow Film Bag



Clear Film Bag







VpCI-126 film



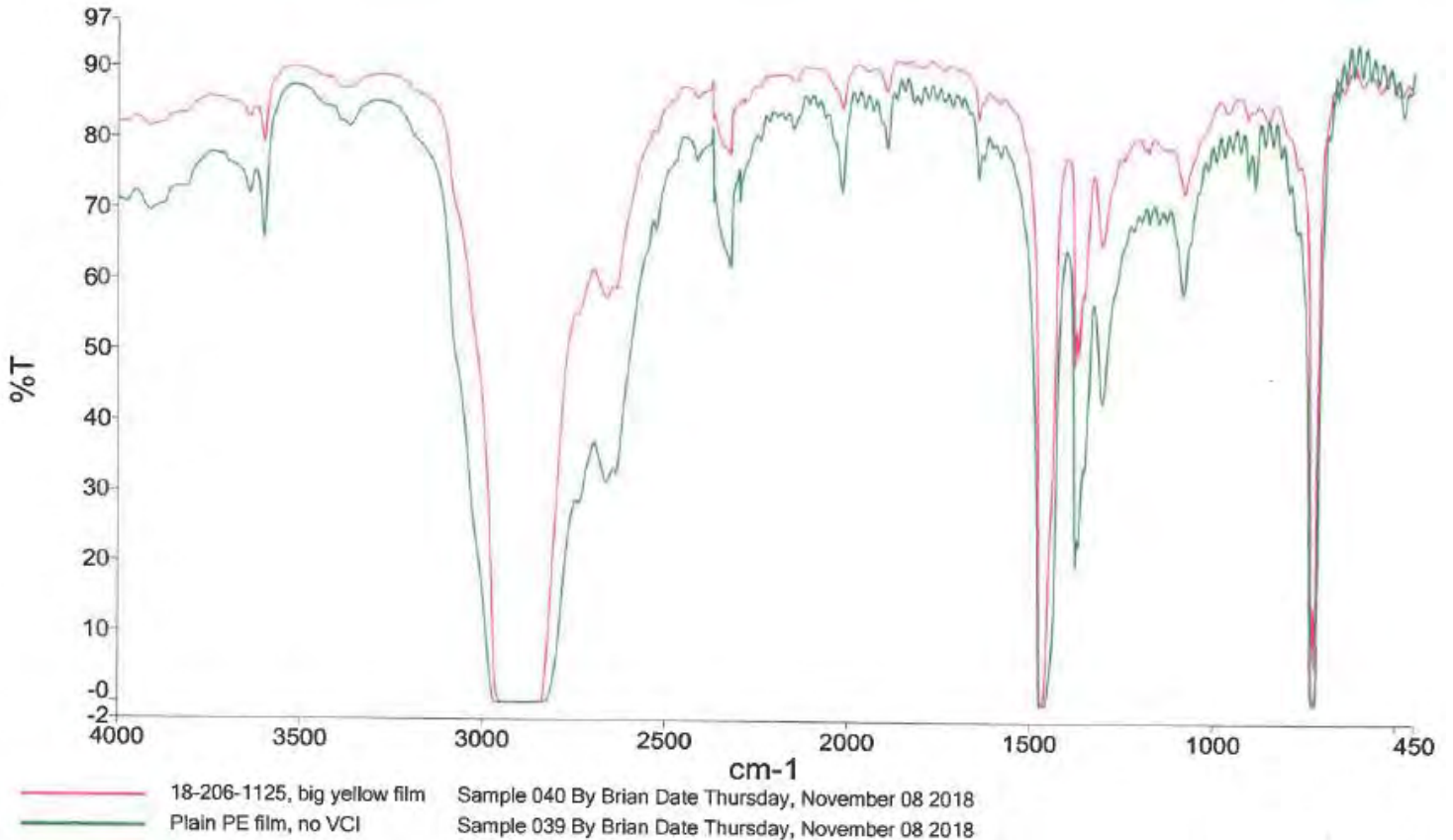
VIA Test Grades (Grade 2 or 3 are passing)

All three plugs must be grade 2 or better to pass the test

		
		Grade 0
Grade 0:	Blind test No corrosion inhibiting effect	
		Grade 1
Grade 1:	Blind test Minute corrosion inhibiting effect	
		Grade 2
Grade 2:	Blind test Medium corrosion inhibiting effect	
		Grade 3
Grade 3:	Blind test Good corrosion inhibiting effect	

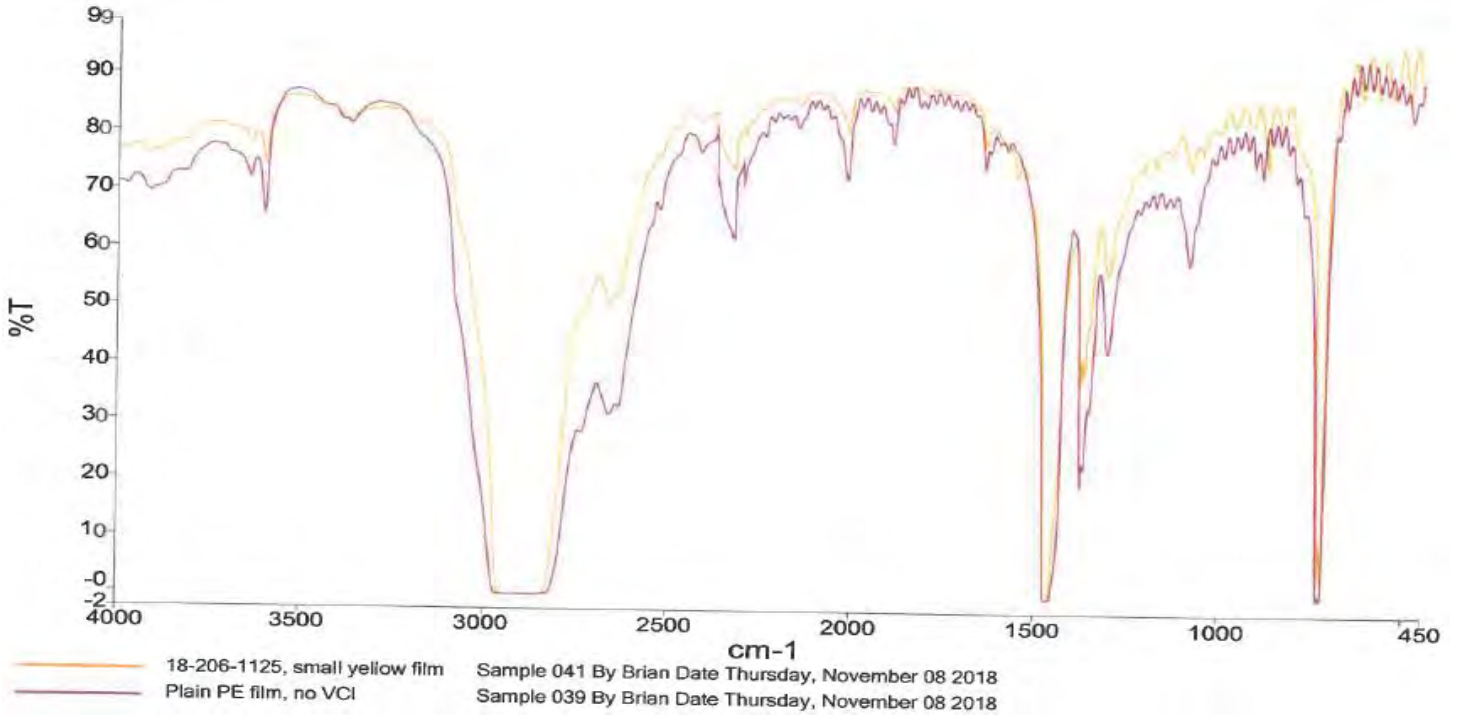
FTIR Analysis:

Big Yellow Film Bag Compared to Plain PE film with no VCI

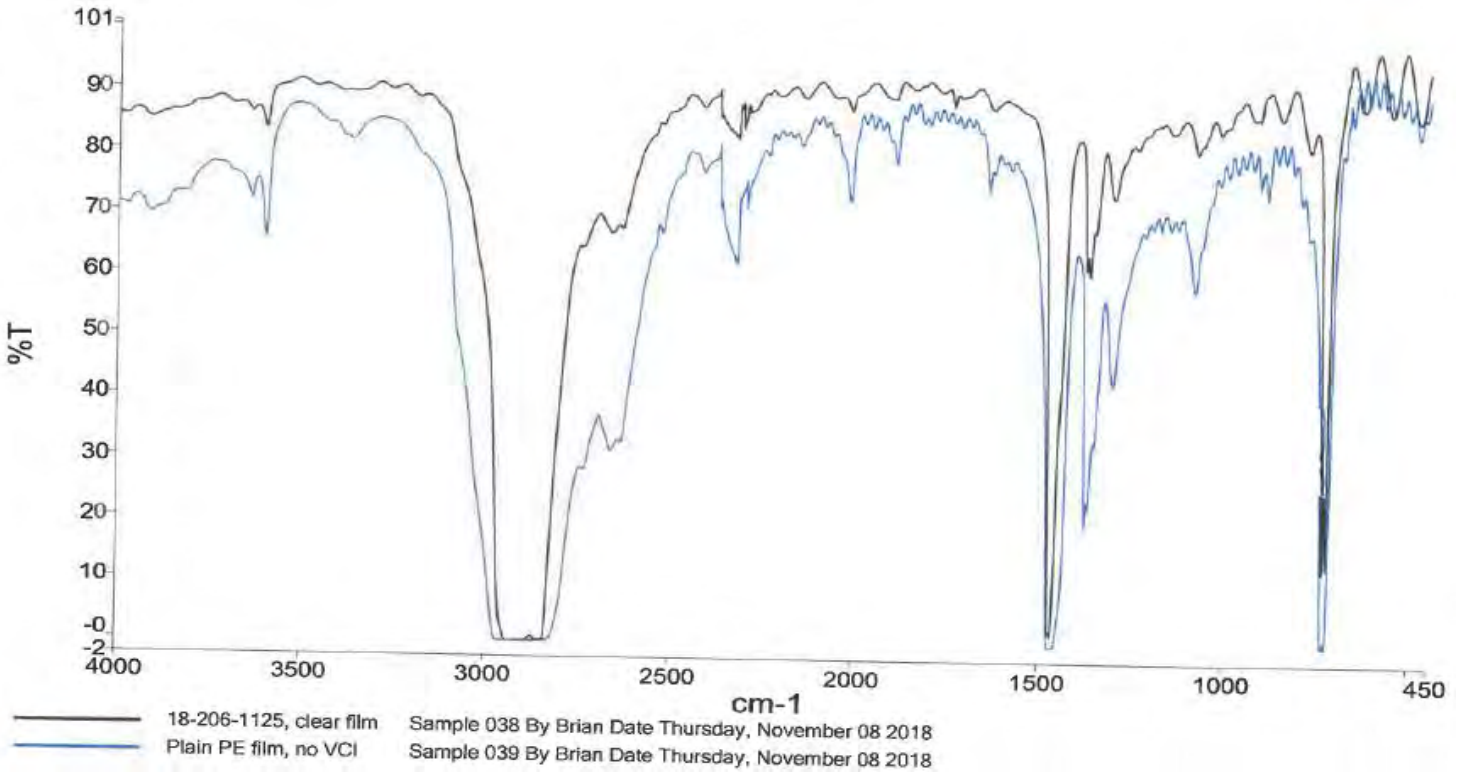


FTIR Analysis:

Small Yellow Film Bag Compared to Plain PE film with no VCI



Clear Film Bag Compared to Plain PE film with no VCI



Interpretations:

The two submitted yellow film bags are primarily nitrite based, and do not appear to contain any other corrosion inhibitors (at measurable levels) according to the FTIR analysis. The smaller yellow film bag was found to contain a higher concentration of nitrite compared to the bigger yellow film bag, and as a result, the smaller bag provides better overall corrosion protection. The bigger yellow film bag does not contain sufficient quantities of nitrite to pass the razor blade test or VIA test. The smaller yellow film bag passed the VIA test and razor blade test for carbon steel, but does not provide contact corrosion protection for copper.

The clear film bag does not contain any nitrite, and appears to be no different than plain polyethylene film without any inhibitor based on the corrosion testing and FTIR analysis.

VpCI-126 film provides excellent vapor phase protection and also provides contact protection for both carbon steel and copper.