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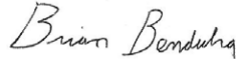
Evaluation of Zerust Film

From: Cortec Laboratories, Inc.
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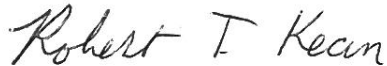
Project #: 17-263-1125.supplemental.bis

Results reported by:



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Lab Technician

Approved by:



Robert T. Kean, Ph.D.
Laboratory Director



Background: A sample of Zerust film was submitted for analysis to determine the corrosion protection properties. This film is used to pack pistons manufactured by our customer in France. The pistons are then shipped to the customer plant in India.

Sample Received: Yellow Zerust Film, Valeno Type F, 3mil (received on 12-27-17 in good condition)

Method: VIA Test, CC-027
 FTIR Analysis, CC-006
 NACE Standard VIA Test, TM0208-2008, item No. 21253*
 Razor Blade Test, CC-004*
 Nitrite/Nitrate Test*
 *The test(s) marked are not covered under Cortec Laboratories, Inc. ISO 17025 Scope of Accreditation

Materials: VIA test kit (testing jars and lids, steel plugs, 400grit sandpaper)
 Carbon Steel panels, SAE 1010 (for razor blade testing)
 Glycerol (lot #Q10A018)
 Methanol, ACS grade (lot #071417B)
 Nitrite/Nitrate Test Strips (lot #HC553793)
 Plain polyethylene film (control film)
 Calibrated Thermometer (SN #41477, lot #5516)
 Kimwipes
 DI water
 Hot plate

Procedure: The testing was conducted according to standard procedures for each test.
 Note- VIA tests were conducted using two strips of sample per jar (1" X 6" per strip)

Results: The following results were found:

Razor Blade Test- Carbon Steel Panels

Sample	Panel #1	Panel #2	Panel #3	End Result
Yellow Zerust film	Pass	Pass	Pass	Pass
Control	Fail	-	-	Fail

VIA Test

Sample	Plug #1	Plug #2	Plug #3	End Result
Yellow Zerust Film	Grade 2	Grade 2	Grade 1	Fail
Control	Grade 0	-	-	Fail

NACE VIA Test

Sample	Plug #1	Plug #2	Plug #3	End Result
Yellow Zerust Film	Grade 2	Grade 2	Grade 1	Fail
Control	Grade 0	-	-	Fail

Nitrite/Nitrate Test Strips

Sample	Results
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Yellow Zerust Film	Tested positive for both nitrite and nitrate
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Photo from the VIA test:

Yellow Zerust Film

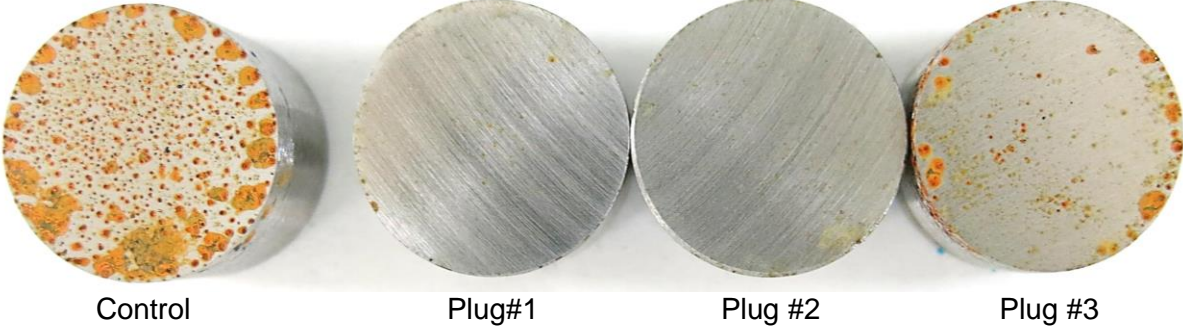
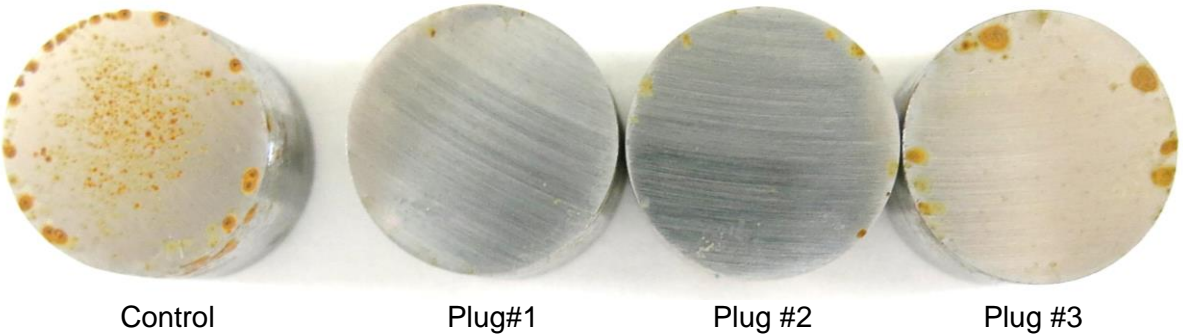
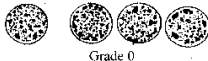

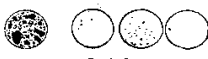
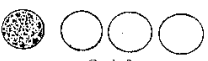


Photo from the NACE VIA test:

Yellow Zerust Film

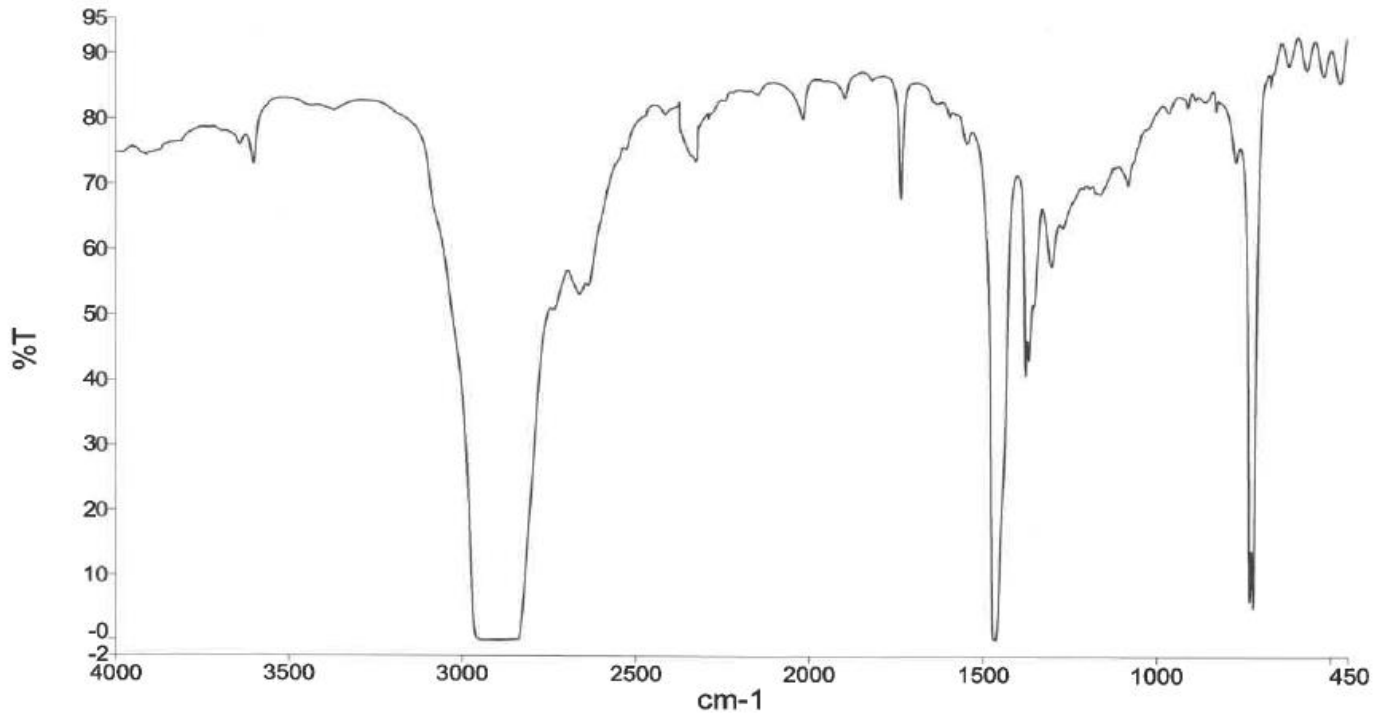


VIA Test Grades (Grade 2 and 3 are passing)

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

FTIR Analysis:

Yellow Zerust Film



Interpretations:

The submitted Zerust film provides sufficient contact corrosion protection to pass the razor blade test, but does not provide enough vapor phase protection to pass the VIA tests.