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Corrosion Inhibiting Properties of Rust-X Packaging Film and Emitter

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Background: Lotus Auto Engineering Ltd currently uses two Cortec rust preventives (RP) liquids as part of their preservation process for various manufactured components. Lotus also occasionally uses an oil based RP from Rust-X. After RP dip, parts are individually wrapped in Rust-X film, and placed into a crate lined with Rust-X film, with Rust-X 4200 emitter/desiccants inside. Recently, corrosion has been seen on parts shipped from Lotus, but only on those surfaces that were in direct contact with the Rust-X film. In this test, Cortec Laboratories will evaluate the corrosion inhibiting efficacy of the Rust-X film and emitter.

Sample Received: 1 blue film bag (unlabeled, but made by Rust-X), 100 micron
1 Rust-X 4200 emitter/desiccant pack

Method: VIA Test, CC-027
FTIR Analysis, CC-006
Razor Blade Test, CC-004*

*Cortec Laboratories, Inc. is not accredited for the test(s) marked.

Materials: Polyethylene film, used as a control
VIA Test kit
Paragon 1000 FTIR
Razor Blade test kit

Procedure: All tests were followed according to standard procedure, except for VIA testing of Rust-X 4200 Pack. Whereas standard VIA procedure involves testing in triplicate, only one Rust-X 4200 Pack was sent. As such, only one VIA plug was used.

Results:

VIA Test Results

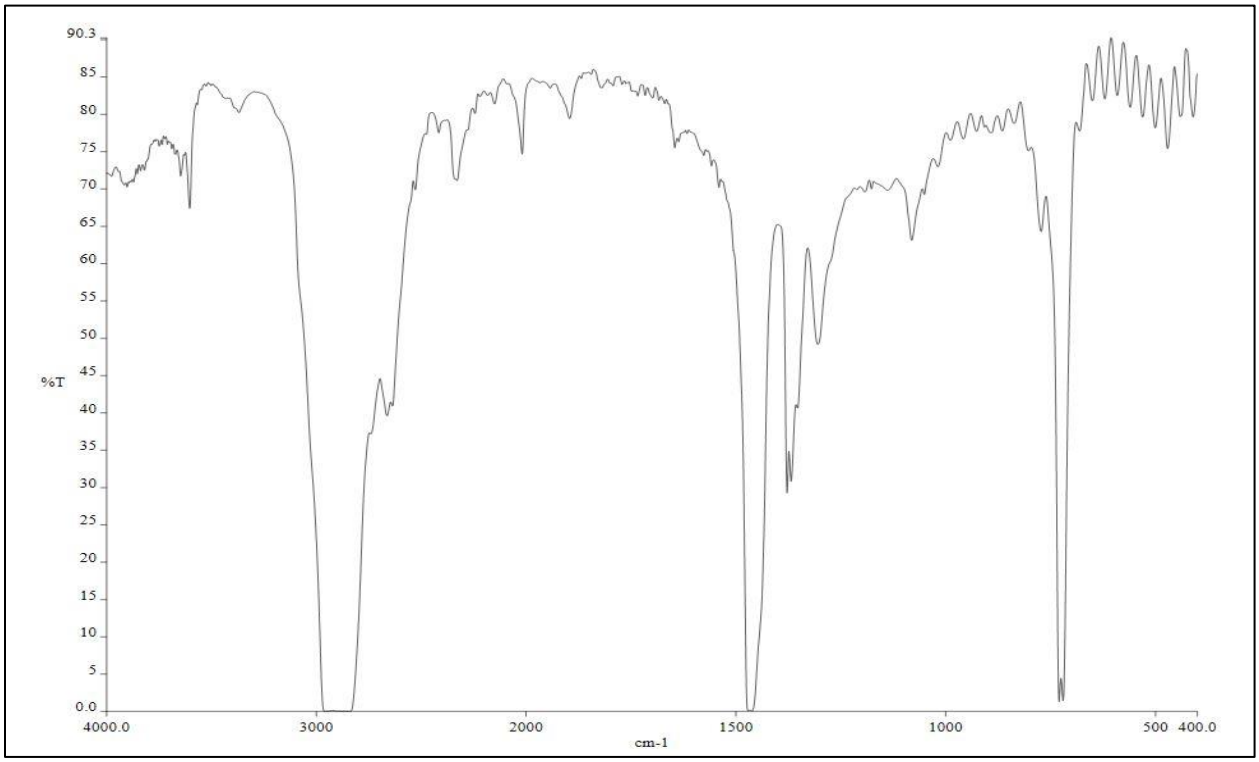
Sample	Plug 1	Plug 2	Plug 3	Overall
Rust-X 4200 Pack	1	**		Fail
Rust-X Film	0	0	1	Fail
Control	0	-	-	Fail

** Because only one pack was included, no duplicate testing was performed

Razor Blade Test Results

Sample	Plug 1	Plug 2	Plug 3	Overall
Rust-X Film (Carbon Steel)	Fail	Fail	Fail	Fail
Rust-X Film (Copper)	Fail	Fail	Fail	Fail
Control	Fail	Fail	-	Fail

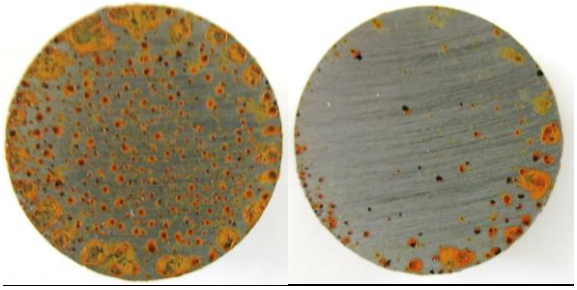
FTIR Results- Rust-X Film



Results relate only to the items tested

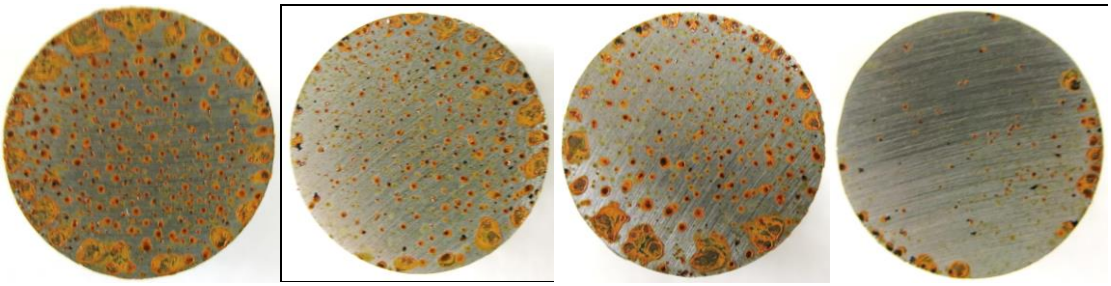
Photos:

VIA Results- Rust-X 4200 Pack



Control Plug 1

VIA Results- Rust-X Film

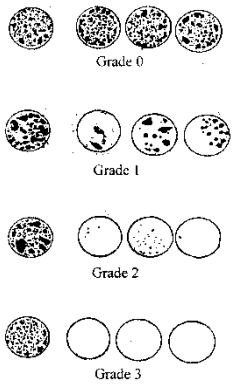


Control Plug 1 Plug 2 Plug 3

VIA Test Grading

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

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



Interpretations: The submitted Rust-X film does not provide sufficient contact corrosion protection for copper or carbon steel, according to razor blade test results. Further, Rust-X 4200 doesn't provide sufficient vapor phase protection for carbon steel, according to VIA results. It should be noted that this test is normally run in triplicate. However, only one Rust X-4200 sample was sent, and as such, only one VIA plug was tested with this product.

According to FTIR results, Rust-X film does not appear to contain any active corrosion inhibitor chemistry. The main component is desiccant, which can provide some protection by decreasing humidity. However, it won't provide any protection once the desiccant is saturated.