www.nts.com

National Technical Systems - Baltimore
5 North Park Drive
Hunt Valley, MD 21030

Main: 410-584-9099
Fax: 410-584-9117

Date In: November 6, 2018

Customer:
Lackweerke Peters Gmbh+Co Kg
Hooghe Weg 13 Kempen
47906 Kempen, DE

Purchase Order Number: Wire Transfer

A. TEST OBJECTIVE:
Determine Total Mass Loss (TML) and Collected Volatile Condensable Materials (CVCM) from Outgassing

B. TEST ITEM(S):
Three (3) customer-prepared cured lacquer materials

C. SPECIFICATIONS / METHODS / TECHNIQUES:
1. ASTM E595-15, Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment

D. RESULTS:
All materials met the historical screening levels outlined in ASTM E595. See Page 3 for results summary.

TEST REPORT PREPARED BY:

Katherine C. Higgs
Special Projects Manager

TECHNICAL/QUALITY APPROVALS:

Elizabeth A. Allison
Department Manager, PCB/PCA

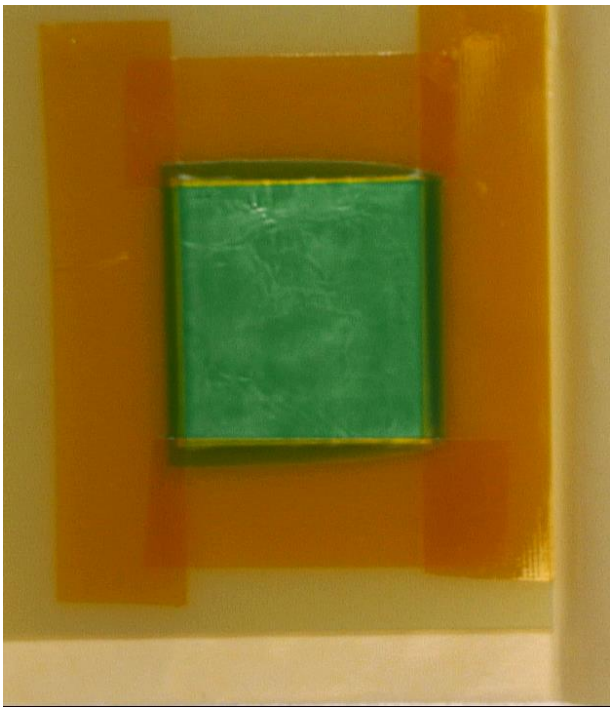
TEST ITEM IDENTIFICATION

SAMPLE TYPE	Cured lacquer prepared on aluminum substrates
NUMBER OF SAMPLES SUBMITTED	Three (3) materials
SAMPLE IDENTIFICATION	See table below
SAMPLE DISPOSITION	Sample consumed during testing

The table below summarizes the sample submission:

SAMPLE IDENTIFICATION		
Material #	**Foil #**	**Description**
1	1	Elpemer AS 2467 SM-DG (218-0702)
	2	
	3	
2	4	Elpemer SD 2463 FLEX-HF (523)
	5	
	6	
3	7	Elpemer SD 2467 SM-DG (733)
	8	
	9	

The images below provide an overview of the sample submission:



Representative Overview of Customer-Prepared Samples

OUTGASSING & TOTAL MASS LOSS

REFERENCE	ASTM E595-15
TEST SPECIMENS	Three (3) materials prepared on pre-weighed aluminum substrates
REQUIREMENT	ASTM E595-15, paragraph 1.5: The criteria used for the acceptance and rejection of materials shall be determined by the user and based upon specific component and system requirements. Historically, a total mass loss (TML) of 1.00% and collected volatile condensable material (CVCM) of 0.10% have been used as screening levels for rejection of spacecraft materials.
SUMMARY	**All materials met the historical screening levels outlined in ASTM E595.**
SAMPLE PREPARATION DETAILS	Nine (9) foil substrates were cut, pre-weighed, and provided to the customer for preparation of specimens in November 2018. After receipt, the test specimens were placed in a preformed, degreased container (boat) and then conditioned at 23°C and 50% relative humidity for a minimum of twenty-four (24) hours prior to testing.
SAMPLE PREPARATION PERFORMED BY	Partner Laboratory
PREPARATION DATE	January 29 – February 12, 2019
TEST MODIFICATIONS	N/A
TEST CONDITIONS	N/A
TEST PERFORMED BY	Partner Laboratory
TEST DATE	February 12-14, 2019
EQUIPMENT USED	0964, 0825, 0916, 0952

RESULTS:

The following table summarizes the test results and detailed results are displayed afterward.

Values listed in **RED** exceeded the historical screening levels outlined in ASTM E595.

PARAMETER	SCREENING LEVEL[1] (%)	AS 2467 (%)	SD 2463 (%)	SD 2467 (%)
% TML	1.00 maximum	0.64	0.34	0.35
% CVCM	0.10 maximum	0.05	0.09	0.05
% WVR	Report	0.61	0.42	0.40

[1] Historically used as screening for spacecraft materials.

Results for Elpemer AS 2467 SM-DG (218-0702)

PARAMETER	SCREENING LEVEL[1] (%)	RESULT (%)
Total Mass Loss (% TML)	1.00 maximum	0.64
Collected Volatile Condensable Material (% CVCM)	0.10 maximum	0.05
Water Vapor Recovered (% WVR)	Report	0.61

[1] Historically used as screening for spacecraft materials.

Raw Outgassing Data			
Replicate	**Mass of Test Specimen (g)**	**Initial Mass of Dried Collector Plates (g)**	**Final Mass of Collector Plates (g)**
1	0.059615	2.740814	2.740895
2	0.062049	3.831632	3.831634
3	0.051970	2.859650	2.859657

Note: There was no change in the control collector plate's weight.

Sample Observations	
Visible Condensate	Yes
Percent Covered	10%
Thin	Yes
Heavy	No
Transparent	No
Opaque	Yes
Interference Fringes	No
Colored Fringes	No
Appearance After Test	No Change

Results for Elpemer SD 2463 FLEX-HF (523)

PARAMETER	SCREENING LEVEL[1] (%)	RESULT (%)
Total Mass Loss (% TML)	1.00 maximum	0.34
Collected Volatile Condensable Material (% CVCM)	0.10 maximum	0.09
Water Vapor Recovered (% WVR)	Report	0.42

[1] Historically used as screening for spacecraft materials.

Raw Outgassing Data			
Replicate	**Mass of Test Specimen (g)**	**Initial Mass of Dried Collector Plates (g)**	**Final Mass of Collector Plates (g)**
4	0.045091	3.472711	3.472723
5	0.041156	3.187239	3.187306
6	0.043295	4.152024	4.152062

Note: There was no change in the control collector plate's weight.

Sample Observations	
Visible Condensate	Yes
Percent Covered	10%
Thin	Yes
Heavy	No
Transparent	No
Opaque	Yes
Interference Fringes	No
Colored Fringes	No
Appearance After Test	No Change

Results for Elpemer SD 2467 SM-DG (733)

PARAMETER	SCREENING LEVEL[1] (%)	RESULT (%)
Total Mass Loss (% TML)	1.00 maximum	0.35
Collected Volatile Condensable Material (% CVCM)	0.10 maximum	0.05
Water Vapor Recovered (% WVR)	Report	0.40

[1] Historically used as screening for spacecraft materials.

Raw Outgassing Data			
Replicate	**Mass of Test Specimen (g)**	**Initial Mass of Dried Collector Plates (g)**	**Final Mass of Collector Plates (g)**
7	0.036746	2.721959	2.721959
8	0.036142	2.901565	2.901576
9	0.046619	3.700898	3.700954

Note: There was no change in the control collector plate's weight.

Sample Observations	
Visible Condensate	Yes
Percent Covered	25%
Thin	Yes
Heavy	No
Transparent	No
Opaque	Yes
Interference Fringes	No
Colored Fringes	No
Appearance After Test	No Change

EQUIPMENT LIST

ID	Manufacturer	Equipment Name	Model Number	Serial Number	Calibration Date	Calibration Due Date
0964	Mettler Toledo	Microbalance	XP26	N/A	20-Jul-2018	20-Jul-2019
0825	PTL	OTS	1	1098	02-May-2018	02-May-2019
0916	Granville-Philips	Vacuum Gauge Controller	340	N/A	13-Mar-2018	13-Mar-2019
0952	Lake Shore	Cryotronics Crypoump Monitor	818	N/A	02-May-2018	02-May-2019

TEST METHOD

OUTGASSING & TOTAL MASS LOSS TEST METHOD

After conditioning, the boat and the specimen were weighed and placed in the specimen compartment in a copper heating-bar that is part of the test apparatus. The copper heating-bar was then placed in the vacuum chamber, which was then sealed.

The vacuum chamber was evacuated to a vacuum of at least 5.0×10^{-5} torr. The heating-bar was raised to a temperature of 125°C. This caused the vapor from the heated specimen to stream from the hole in the specimen compartment. The vapor passed through the collector chamber where the vapor condensed on a previously-weighed and independently temperature-controlled, chromium-plated collector plate that was maintained at 25°C.

After 24 hours, the test apparatus was cooled and the vacuum chamber was then re-pressurized with a dry, inert gas. The specimen and the collector plates were weighed. The TML and CVCM percentages were then determined.

After the specimen was weighed to determine the TML, the WVR was determined by conditioning the specimen at 23°C with 50% relative humidity for 24 hours. The specimen was again weighed and the percent WVR was calculated.

REVISION HISTORY

Rev.	Revision Date	Description
0	19-Feb-2019	Initial release

END OF REPORT