

***Stratasys DDM Group***  
***Outgassing Test Report***  
***ASTM E 595***

***Test House:***

***NuSil – Carpinteria, CA***

***Contact – Thad Jones***

***Revision Dates:***

<b><i>NC</i></b>	<b><i>2011-10-26</i></b>	<b><i>No Change - First Release</i></b>
<b><i>A</i></b>	<b><i>2011-10-26</i></b>	<b><i>Added Results of SR 100</i></b>



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## OVERVIEW

Fused deposition modeling is being utilized for a variety of tooling and end use parts applications. Some applications require that materials have minimal or no out gassing. This is often the case for parts that will be used in space or optical systems. In some tooling applications it is important to know that no impurities are being introduced into the fabrication process by the tools themselves, often the case for composite tooling. For these applications users needed to understand the outgassing behaviors of a material being considered for the application. An industry recognized and accepted test procedure for outgassing is ASTM E 595. Appendix A provides good overview of the test procedure as conducted by NuSil. This test report provides the data that has been collected and the third party tests houses that were utilized to obtain that data. Only accredited third party test facilities that are recognized in the industry will be included in this report.

## TEST RESULTS SUMMARY

Stratasys Product	Test Procedure	Test Facility	Pass / Fail	Doc. Rev
<b>ULTEM 9085</b>	ASTM E 595	NuSil	Pass	NC
<b>SR 100</b>	ASTM E 595	NuSil	Pass	NC

## TEST PROCEDURE

Stratasys provides 5 grams of FDM material that has been deposited by a Fortus machine. The material is processed per ASTM E 595 and tested. NuSil's test procedure TM072G is on file for reference as required.

## TEST RESULTS

The detailed results for each material tested are provided in the following sections.

# STRATASYS DIRECT DIGITAL MANUFACTURING GROUP OUTGASSING TEST REPORT



ULTEM 9085



## TEST REPORT FOR: MASS LOSS AND COLLECTED VOLATILE CONDENSABLE MATERIALS

CUSTOMER: STRATASYS  
139 GLENALLEN DRIVE  
ST. PETERS, MO 63376

ORDER # 145186

ATTENTION: BILL MACY

P.O. #: CC

SAMPLE #: 17951

TEST POSITION #: 2

MATERIAL TESTED: UITEM 9085

LOT: N/A

TEST DATE: 03/09/11

TEST NUMBER: 3857

PRESSURE (torr): 1.2XE-6

	SPECIFICATION LIMITS	RESULTS:	DETECTION LIMITS
Total Mass Loss (TML):	1.00 % maximum	0.41	0.01
Collected Volatile Condensable Material (CVCN):	.10 % maximum	< 0.01	0.01
Water Vapor Recovered (WVR):	Report	0.37	0.01

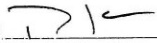
OBSERVATIONS: NO

Visible Condensate:	NO	Transparent:	NO
Percent Covered:	N/A	Opaque:	NO
Thin:	N/A	Interference Fringes:	NO
Heavy:	N/A	Color of Fringes:	N/A

COMMENTS: None

SPECIMEN APPEARANCE AFTER TEST: No Change

If you have any questions regarding this report, please call  
the Commercial Testing Coordinator at (805) 566-2870  
TESTING PERFORMED IN ACCORDANCE WITH ASTM E-595.

By:   
Quality Assurance Designate  
Date: 03/09/11

NuSil Technology LLC

1050 Cindy Lane • Carpinteria, CA 93013 • 805/684-8780 • 805/566-9905 Fax • www.nusil.com

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# STRATASYS DIRECT DIGITAL MANUFACTURING GROUP OUTGASSING TEST REPORT



SR100



## TEST REPORT FOR: MASS LOSS AND COLLECTED VOLATILE CONDENSABLE MATERIALS

CUSTOMER: STRATASYS INC.  
7640 COMMERCE WAY  
EDEN PRARIE, MN 55444

ORDER # 153609

ATTENTION: BRIAN SABART

P.O. #: CC

SAMPLE #: 18542

TEST POSITION #: 2

MATERIAL TESTED: SR100

LOT: N/A

TEST DATE: 10/05/11

TEST NUMBER: 3961

PRESSURE (torr): 1.3XE-7

	SPECIFICATION LIMITS	RESULTS:	DETECTION LIMITS
Total Mass Loss (TML):	1.00 % maximum	1.01	0.01
Collected Volatile Condensable Material (CVCM):	.10 % maximum	< 0.01	0.01
Water Vapor Recovered (WVR):	Report	0.80	0.01

OBSERVATIONS: NO

Visible Condensate:	NO	Transparent:	NO
Percent Covered:	N/A	Opaque:	NO
Thin:	N/A	Interference Fringes:	NO
Heavy:	N/A	Color of Fringes:	N/A

COMMENTS: None

SPECIMEN APPEARANCE AFTER TEST: No Change

If you have any questions regarding this report, please call  
the Commercial Testing Coordinator at (805) 566-2870  
TESTING PERFORMED IN ACCORDANCE WITH ASTM E-595

By: DK  
Quality Assurance Designate  
Date: 10/05/11

NuSil Technology LLC

1050 Cindy Lane • Carpinteria, CA 93013 • 805/684-8780 • 805/566-9905 Fax • www.nusil.com

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## SMSG CONTACTS

Bill Macy

[Bill.macy@stratasys.com](mailto:Bill.macy@stratasys.com)

o 636.294.9109

Brian Sabart

[Brian.sabart@stratasys.com](mailto:Brian.sabart@stratasys.com)

o 952.906.2733

Webpage

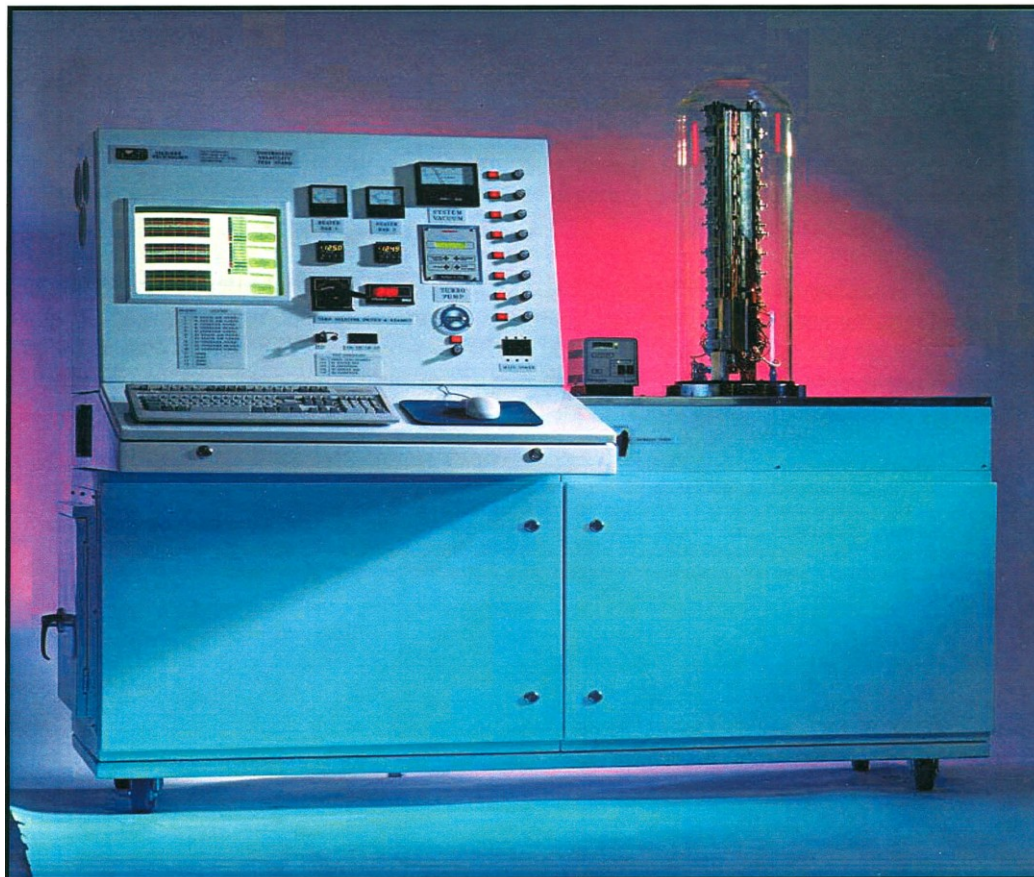
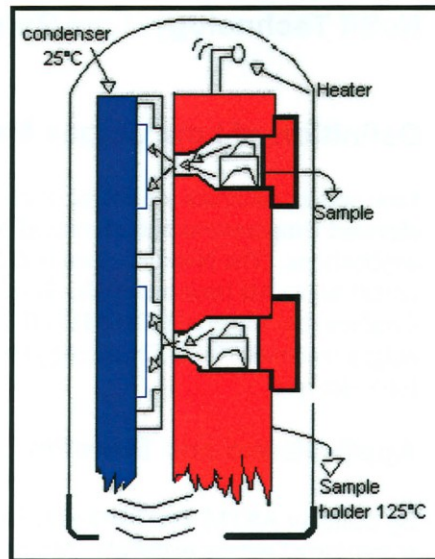
[www.stratasys.com/smsg](http://www.stratasys.com/smsg)

## APPENDIX A – NUSIL TEST PROCEDURE SUMMARY

### Test Method ASTM E 595

#### ASTM Test Method E 595 Procedure Summary:

Each material sample undergoes preconditioning. Preconditioning is conducted at 50% relative humidity and ambient atmosphere for twenty-four hours. The sample is weighed and loaded into a compartment within a test stand. The sample is then heated to 125°C at less than  $5 \times 10^{-5}$  torr for 24 hours. Any volatile components of the sample outgas in these conditions. The volatiles escape through an exit port and, if condensable at 25°C, condense on a collector plate maintained at that temperature. The samples are post-conditioned in 50% relative humidity and ambient atmosphere for a twenty-four hour minimum. The collector plate and samples are then weighed again to determine the percentage of weight change, determining TML% and CVCM%.





## NuSil Technology- Low Outgas Materials

### Definition of Low Outgas Materials

Low outgas materials are characterized by their minimal volatility when exposed to the elevated temperatures and decreased pressures historically associated with extraterrestrial applications. The National Aeronautics & Space Association's (NASA) criteria for low outgas materials limit materials' Total Mass Loss (TML) to 1.0% and Collected Volatile Condensable Material (CVCN) to 0.10%. To adhere to NASA's requirements for a low outgas material, NuSil Technology utilizes ASTM's Test Method E 595\* as a standard, lot-to-lot test.

### Applications and Benefits

By utilizing ASTM Test Method E 595, NuSil Technology aids its customers with the screening of outgas materials. Materials exhibiting minimal volatility have a low potential for contaminating surrounding components or assemblies. While these materials are regularly considered for use in aerospace (extraterrestrial) applications, benefits of these materials may extend to:

- Electronic Applications,
- High Vacuum Applications, and
- Clean Room Applications.

Many standard product properties such as optical clarity, thermal and electrical conductivity, and high dielectric strength can be found in NuSil Technology's standard line of low outgas materials.

NuSil Technology, an ISO-9001 certified company, is an industry leader in developing, manufacturing and testing low outgas materials. Continually adhering to NASA requirements and ASTM standards, NuSil Technology supports our various customers by supplying accurate outgas testing, a broad line of low outgas silicones, and developing custom silicone materials to meet unique customer specifications.

\*ASTM Test Method E 595 Procedure Summary: Each material sample undergoes preconditioning. Preconditioning is conducted at 50% relative humidity and ambient atmosphere for twenty-four hours. The sample is weighed and loaded into a compartment within a test stand. The sample is then heated to 125°C at less than  $5 \times 10^{-5}$  torr for 24 hours. Any volatile components of the sample outgas in these conditions. The volatiles escape through an exit port and, if condensable at 25°C, condense on a collector plate maintained at that temperature. The samples are post-conditioned in 50% relative humidity and ambient atmosphere for a twenty-four hour minimum. The collector plate and samples are then weighed again to determine the percentage of weight change, determining TML% and CVCN%.