

## Out-gassing study results for Optical InterLinks polymer products:

Optical InterLinks successfully completed out-gassing tests on our polymer film products instigated by one of our customers. Results indicated that out-gassing volatile solids content was below the specified maximum. The work was done by NuSil Technology LLC who was contracted as recommended by contacts at General Dynamics who use their services. NuSil required 5 grams of sample films or enough to run 3 tests that was their required minimum to get reliable results. The sample was representative of typical material constituent ratios used in Optical InterLinks' polymer waveguide products including all waveguide and packaging polymers, epoxies, and adhesives. The 5 grams of material also represents at least 3 complete photomask exposures that is enough to produce many 10's or more of devices or links for most applications. Attached is NuSil's final report.

Below I have summarized their procedure and reported results that we also discussed and reviewed with them by phone.

- 1) Holding the samples at 50% relative humidity at 23C for 24 hours
- 2) Weighing the sample that was equilibrated under 1)
- 3) Holding the sample at 125C for 24 hours under vacuum
- 4) During 3) collecting volatile condensable constituents on a cool plate held at 25C located in the vacuum chamber exhaust
- 5) Weighing the sample after the heat / vacuum operation to determine the total mass loss which for our sample was 1.14% by weight that is slightly above the 1% goal
- 6) Weighing the amount of collected volatile condensable material (CVCM) on the cool plate which for our sample was 0.09 %by weight and below the 0.1% goal
- 7) Holding the sample at 50% RH and 23C for 24 hours to reintroduce moisture
- 8) Weighing the sample equilibrated under 7) which for our sample showed an increase of 0.47% by weight water vapor recovered (WVR) or moisture take up. This suggests that the volatile solids removed by vacuum / heat from the original sample were approximately 0.67% by weight with 0.09% of that collected on the cool plate.

Should the presence of moisture in our products be a concern then storage in a desiccate box or under a vacuum for a short time would remove most moisture before the product is sealed in a package. For space/aerospace applications moisture would be removed under the inherent low pressure conditions. The important result is that the volatile solids content that out-gassed was well within the specified acceptance criteria.



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

CUSTOMER: OPTICAL INTERLINKS  
206 GALE LANE  
KENNETT SQUARE, PA 19348

ORDER #: 106912

ATTENTION: KEVIN HAIR

P.O. #: CC

SAMPLE #: 15512

TEST POSITION #: 4

MATERIAL TESTED: OUTGAS SAMPLE #1

LOT: N/A

TEST DATE: 05/21/08

TEST NUMBER: 3423

PRESSURE (torr): 1.1 XE-5

	SPECIFICATION LIMITS	RESULTS:	DETECTION LIMITS
Total Mass Loss (TML):	1.00 % maximum	1.14	0.01
Collected Volatile Condensable Material (CVCM):	.10 % maximum	0.09	0.01
Water Vapor Recovered (WVR):	Report	0.47	0.01

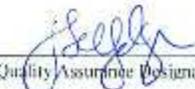
OBSERVATIONS: YES

Visible Condensate:	YES	Transparent:	NO
Percent Covered:	>75%	Opaque:	YES
Thin:	N/A	Interference Fringes:	NO
Heavy:	YES	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-555

By:   
Quality Assurance Designate  
Date: 22 May 08

NuSil Technology LLC

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