

**Accelerated UV Exposure Testing of
Customer Supplied Fabric**

8/20/2010

Measurements performed by:

Drew Hmiel

**Accelerated UV Exposure Testing of
Customer Supplied Fabric**

8/20/2010

CUSTOMER INFORMATION:

Tony Anderson
Textum Weaving
3 Caldwell Drive
Belmont, NC 28012
(704) 822-2400
Tony Anderson [Tony@textum.com]

OBJECTIVE:

Test the customer supplied material to the ASTM-D-2565 standard, “
This will be accomplished by exposing the customer supplied material to an equivalent of 5 years
of ultraviolet radiation similar to the incident Solar UV measured at a tropical location latitude
26°, similar to Miami, FL. The sample is a flat woven fabric.

TEST and MEASUREMENT EQUIPMENT:

Solar Light Co. model 16S-**300** UV Solar Simulators producing a 20 mm diameter circle.
This is a Short Arc Xenon light simulator.

The filters used are: stock **UG11** and **WG 320**. Their age is approximately 5 years. There were no
filter changes during the exposure.

Solar Light Co. model PMA2100 dual channel datalogging radiometer serial number **3198**

Solar Light Co. model PMA2103 UVA+B detector serial number **10700**

TEST SETUP:

The model 16S-**300** UV Solar Simulator was configured to produce a **20** mm-diameter circle for
radiation of the material. The model 16S reproduces solar ultraviolet and eliminates the visible
and infrared components of the light spectrum. See Appendix, Figure 1. The spectral response of
the solar simulator vs. solar spectrum is shown in figure 1. The output of the simulator was
measured and recorded with the PMA2107 UVA+B detector. The irradiance at the sample plane
(average along a diameter) was 48 mW/cm². The UVA+B detector has a non-weighted response.
See Appendix, Figure 2.

TEST METHODS:

Each sample was mounted on a fixture to expose the material at the focus of the specified diameter spot projected by the simulator. A baseline photograph is normally taken to document the starting condition. Prior to initiating the exposure, the intensity was measured for several locations across the spot. The average over the nominal uniformity (>70% of the maximum) was used to define the irradiance rate, per Annex A1 of ASTM-G151. This was a continuous UV only exposure test without water spray. The samples were at a nominal (uncontrolled) temperature of 30°C and humidity of 70% during the test.

The basis for this **Temperate Zone** dose profile was calculated from the daily measured UVA and UVB irradiances at Latitude 40° 06' in Glenside, PA, USA, over the years 2003, 2004 and 2005. These measurements take into account environmental and time-of-year factors. The total dose for the experiment is calculated by multiplying the number of years times the *Annual Tropical Exposure of 243,238 kJ/m²*.

This dose, when divided by the hourly dose, a figure derived from irradiances measured across the exposure spot, results in the hours of *expected* exposure necessary for the test. The measured output of the Simulator was **48 mW/cm²** which resulted in a **144** hour exposure to deliver each equivalent annual UV dose. A total of 5 years UV exposure was applied to the sample.

The Test Protocol that is specifically followed is the UV exposure portion of the ASTM G155 specification: "Standard Practice for Operation of Xenon Arc Apparatus for Exposure of Non-Metallic Materials." And ASTM D 2565 "Xenon Arc Exposure of Plastics Intended for Outdoor Applications".

RESULTS:

The irradiated spot was slightly visible after the exposure. The viewing angle and light source had a dramatic effect on the ability to see the exposure spot. Under particular lighting, at a particular angle a 'yellowed' spot' was visible. However, under most viewing conditions, the spot was difficult to find. It is our judgment that the sample passed the test for UV exposure.

Appendix

Figure 1. Solar Simulator vs. Solar Spectrum

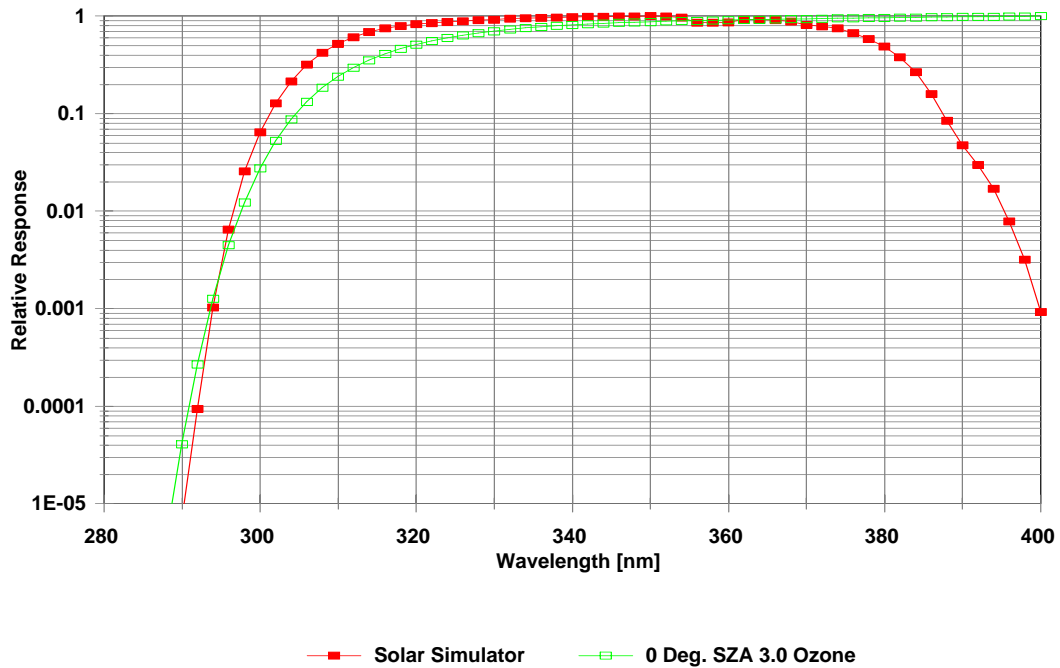
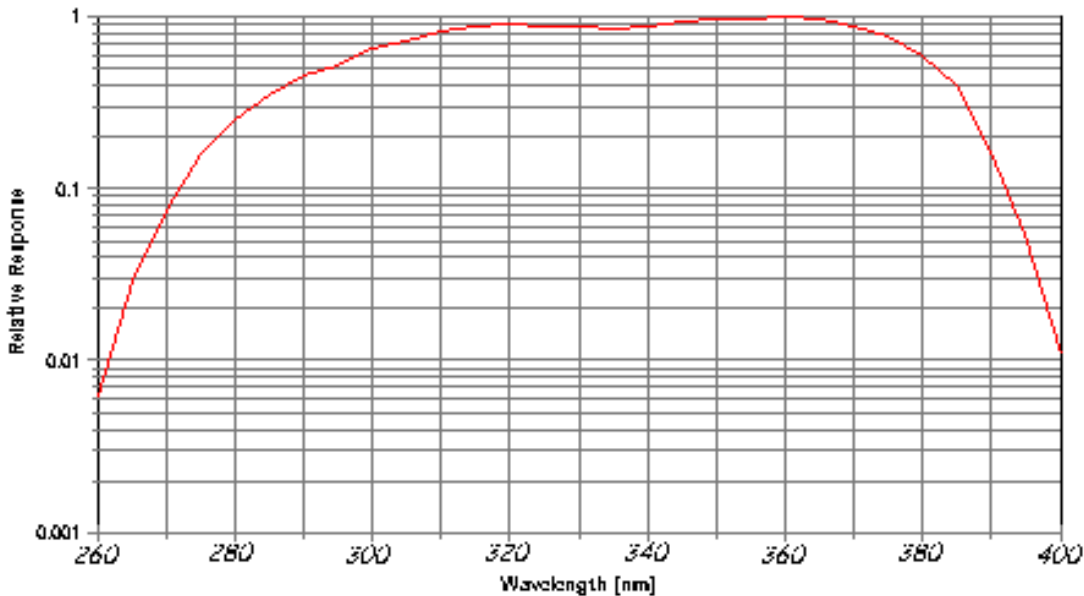


Figure 2. Spectral sensitivity of the PMA 2107 Sensor



REFERENCES:

ASTM G155 specification: "**Standard Practice for Operation of Xenon Arc Apparatus for Exposure of Non-Metallic Materials.**" ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428

Green, Cross & Smith, **Improved Analytic Characterization of Ultraviolet Skylight**, Photoderm. Photobiol. 36, pp.187-191 (1982)

Measurements of Ultraviolet Radiation in the US and comparisons with Skin Cancer Data

The National Cancer Institute Division of Cancer Cause and Prevention
DHEW NO. (NIH) 76-1029 Page 2.2 Annual UV Count with Associated Location Data

Grobner, Kouremeti, and Rembges, **A systematic comparison of solar UV radiation spectra with radiative transfer calculations**, Eighth European Symposium on the Physico-Chemical Behaviour of Atmospheric Pollutants, Torino, Italy, September 2001.

Data summaries of World Recording stations is available at:

http://www.woudc.org/data_e.html