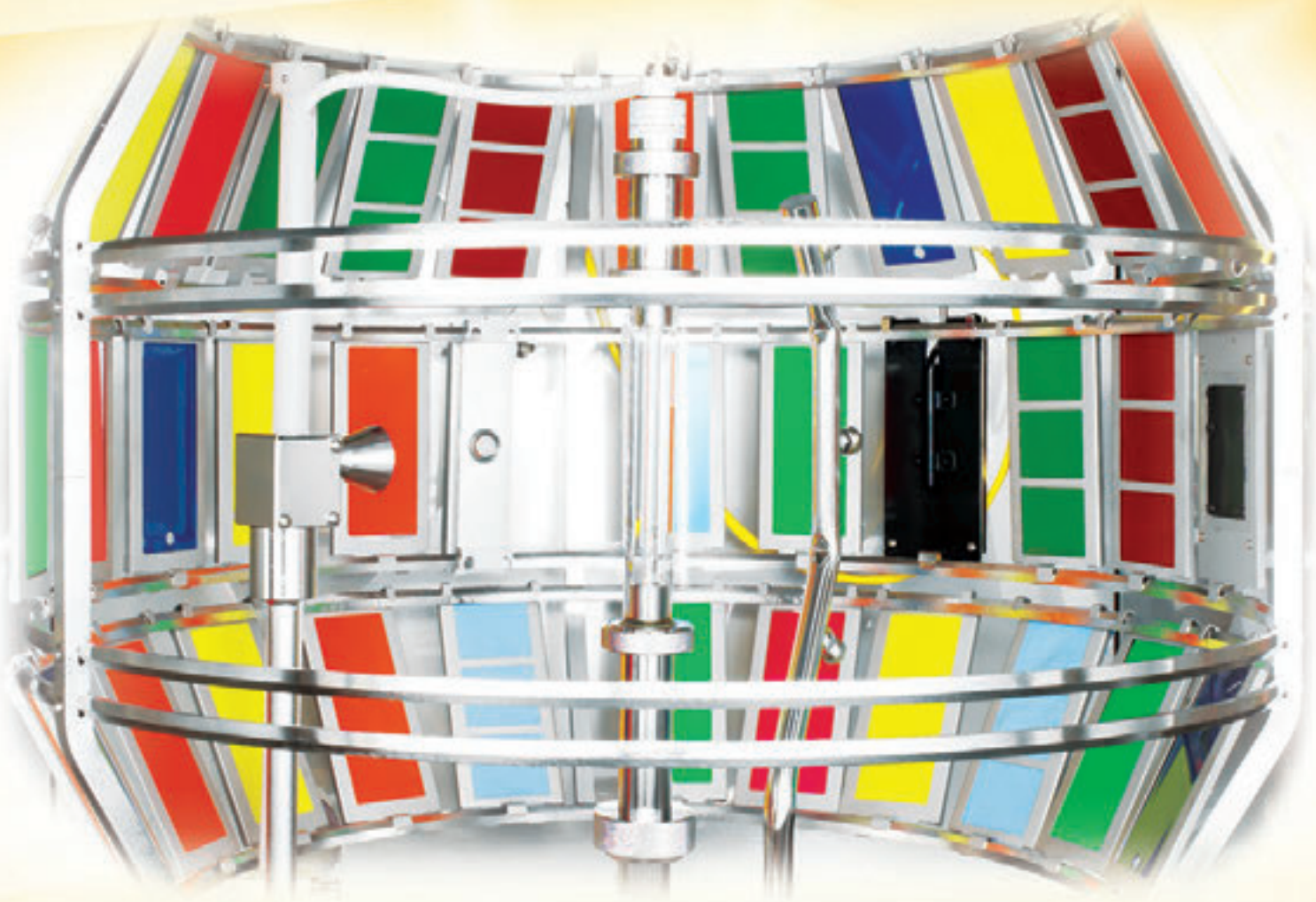


Right Light™ Filter Technology

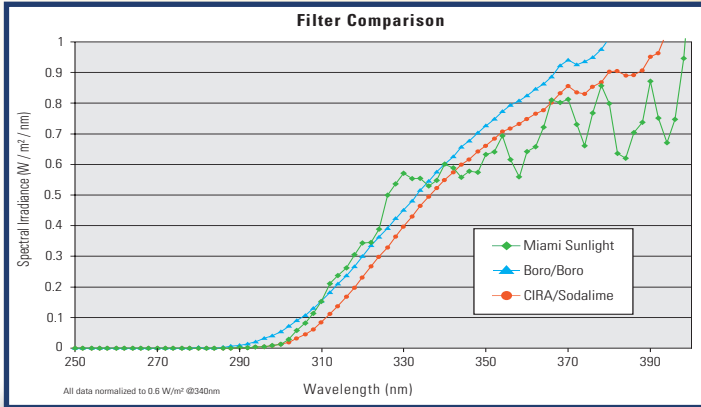


A Better Match to Sunlight

Better Tests = Better Results

The Right Light™ Story

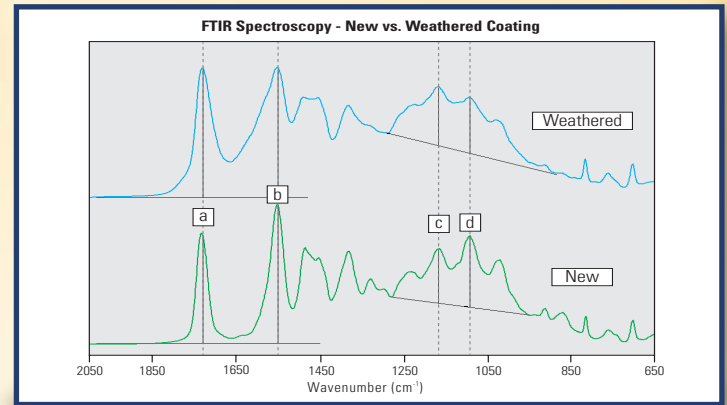
Wavenumber ratio



Xenon arc filters used in weathering tests are assessed mostly by the physical measurement of their UV spectral transmittance. However, given the inherent variability in such measurements, they may be insufficient to make critical judgments. In addition to transmittance measurements, the procedure described herein as the Ford Methodology (The Method), incorporates a procedure involving actual weathering tests of a carefully selected coating material. This approach of combining filter transmittance measurements with a novel chemical evaluation technique of material test results was used in the development of the Right Light™ filter technology.

The Motivation

To create more accurate accelerated weathering tests by using xenon filters that produce a precise match to sunlight, particularly in the UV. It has been found that small deviations from solar UV cut-on are more important than previously thought.*



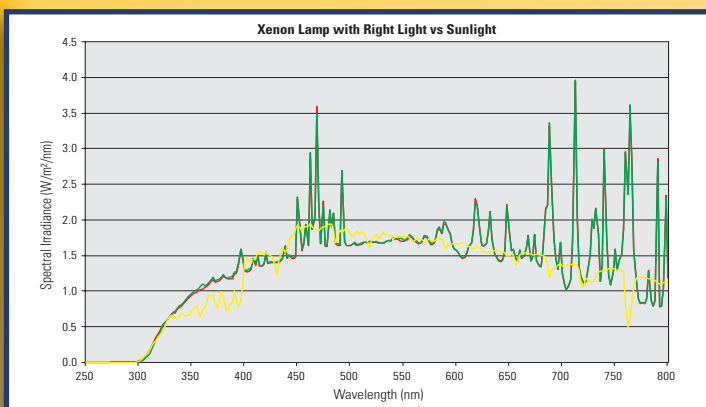
The Ford Methodology (The Method)

A method that uses chemical analysis to objectively identify a sufficiently close laboratory light source was developed by Ford Motor Company. Chemical evaluation is the most critical type of analysis of weathered samples.

The method evaluates and compares chemical changes of the weathered selected coating exposed in accelerated laboratory and natural weathering tests:

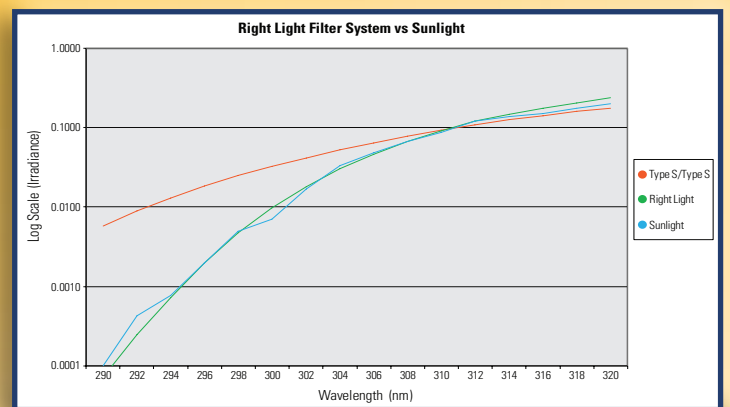
- Judged by comparing spectroscopic curves of weathered and new samples
- Uses peak heights plot ratios – $\Delta[a/b]$ versus $\Delta[c/d]$ to compare spectra

Comparable chemical changes mean sufficiently comparable (or similar) light sources.



Using the Method to Develop a Correct Filter

Equipped with this sensitive and effective method, Atlas, in partnership with Ford Motor Company, launched a program to develop the Right Light filter.

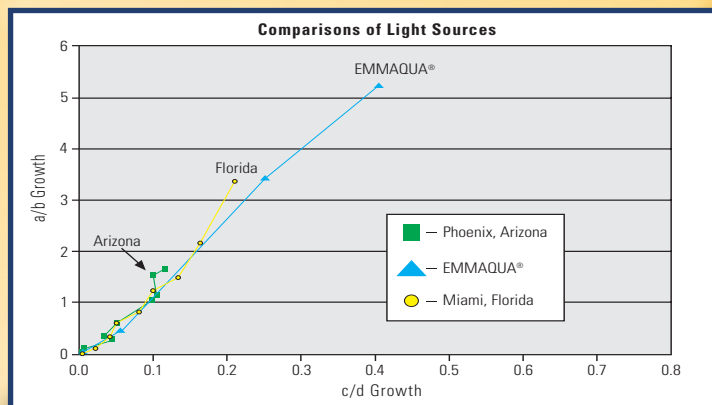


New Right Light Filter Technology - A Significant Improvement

The figure above illustrates the spectral power distribution (SPD) of a xenon light source with Right Light filters when compared to the historic daylight filter combination and Miami sunlight. The logarithmic scale of spectral irradiance accentuates the superior match of Right Light to Miami sunlight.

The Chemistry Proves It

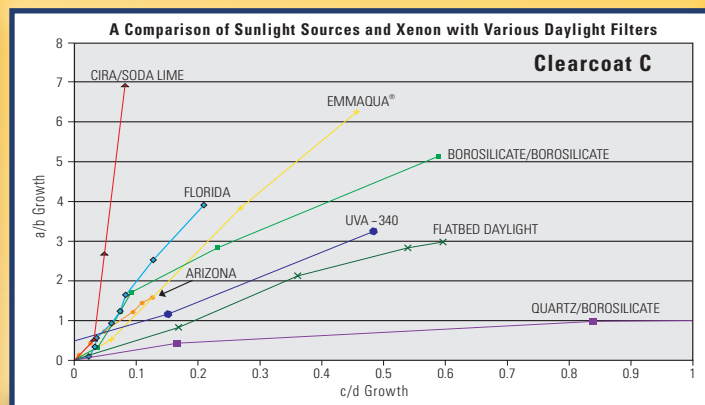
procedure applied to critical coating sample sensitive to solar cut-on



The Method Identifies Correct Light

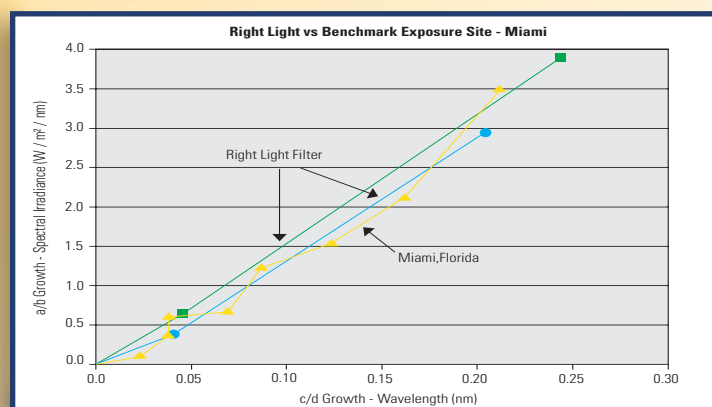
When the method is applied to samples exposed to sunlight in Miami, Florida, Phoenix, Arizona and in an EMMAQUA® (concentrated sunlight) accelerated outdoor weathering device, it shows that similar chemistry is occurring in all cases. This is demonstrated in the figure above which illustrates the closely matched slope of each line.

The ability of the method to repeatedly group these light sources was verified in a number of weathering experiments.



The Method Identifies Light That is Sufficiently Close to Sunlight

When the method is applied to results from the use of various commonly used laboratory light sources, significantly varied (or widely spread) plots are produced that suggest the occurrence of different chemistries. Therefore, the method is demonstrably sensitive enough to clearly discriminate between light sources that may not appear to be significantly different when merely examining plots of the spectral power distribution (SPD) measurements.



The Method Indicates a Close Match to Sunlight and Right Light

When the method is applied to irradiance measurements from a benchmark outdoor exposure site in Miami, Florida and compared against those of the Right Light filter technology, as shown in the graph above, the new filter again closely matches sunlight. This comparison strengthens prior test results and reaffirms that similar chemistry is occurring in both situations.

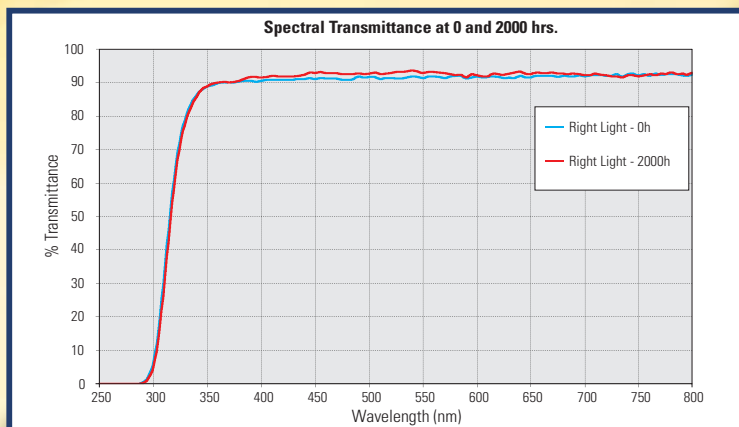
*References and Acknowledgements

The method described herein and used extensively in the development of the Right Light™ filter was developed by Drs. John Gerlock & Mark Nichols of the Ford Motor Company and was cited in a number of publications and presentations, including the following:

- Accelerated Weathering of Automotive Coatings: Exposure Conditions and Analysis Methods**
Dr. Mark Nichols, et al, Ford Motor Company ATCAE Conference, Oxford, UK, September 16, 2008
- Refining Accelerated Weathering Testing to Anticipate Outdoor Exposure Performance**
Dr. Mark Nichols, et al, Ford Motor Company 2010 International Symposium on Natural and Accelerated Weathering Tokyo, Japan, October 6, 2010
- Testing Accelerated Weathering Tests for Appropriate Weathering Chemistry: Ozone Filtered Xenon Arc**
J. L. Gerlock, C. A. Smith, A. V. Kucherov, T. Misovski, C. M. Seubert, R. O. Carter III, and M. E. Nichols, Ford Motor Co., Ford Research Laboratory \ Federation of Societies for Coatings Technology 80th Annual Meeting, Morial Convention Center, New Orleans, US, Joseph J. Mattiello lecture, October 30, 2002

Additional Benefits of Right Light™ Technology

- ◆ Right Light Technology can be used in all Atlas Ci Weather-Ometers
- ◆ Spectral power distribution of Right Light meets the requirements of ASTM D7869-13 “Standard Practice for Xenon Arc Exposure Test with Enhanced Light and Water Exposure for Transportation Coatings,” and all test methods that specify a “Daylight” filter, such as ASTM G155 and ISO 4892-2
- ◆ A Right Light/Quartz filter combination has higher transmittance than a new Type S Boro/Type S Boro combination at 340 nm, providing several additional benefits:
 - 15% less lamp power required to run at the same irradiance level, **reducing overall operating costs**
 - Since Right Light ages less rapidly, **operating cost savings will increase over time**
 - Less lamp power means less near-infrared irradiance, resulting in a **wider available temperature operating range** and lower fan speeds to maintain BPT/BST temperatures
 - Lower fan speeds exhaust less warm air from the instrument, resulting in **lower laboratory air conditioning costs**
 - **Higher irradiance achieved** at maximum lamp power levels



Unparalleled Aging Stability

The Right Light filter is unlike any other filter on the market today. Showing negligible or no change in UV transmittance with long term use, the Right Light filter ensures test repeatability over its service life.



Atlas Sealed Lamp

Longer Filter Life

Right light will last as long as a xenon lamp. Therefore, it only needs to be changed when a new lamp is installed.

The Right Light filter can be used for up to 2000 hours, the recommended service life of our long arc xenon lamp, eliminating testing downtime for filter changes.