ATLAS
MATERIAL TESTING SOLUTIONS

Material Testing Product
and Technology News

Volume 34
Issue 72

# SunSpots

*Fall 2004*

## Better Uniformity Cuts Cost in Accelerated Weathering Tests

*by S. Jay Lipscomb, Product Manager, Weathering Instrumentation Products and Mark Chomiczewski, Strategic Sales*

### *Introduction*

Today's companies have been charged with bringing products to market faster with less cost. To accomplish this, they look to cut cost and reduce time along every step of the development process. Weathering tests are part of that process. In determining a product's weatherability, answering two key questions may help:

- How does uniformity of the three main weathering parameters—solar radiation, temperature, and moisture—at the sample surface affect throughput and ultimately the cost of a laboratory accelerated weathering test?
- Is there correlation between the variability of an accelerated weathering instrument and the number of replicates necessary to achieve acceptable levels of confidence in the data generated by them?

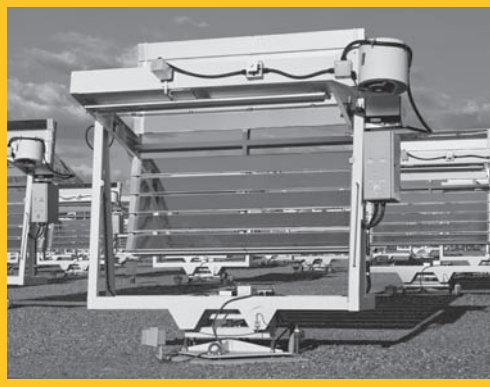
Uniformity and variability are converse concepts; higher uniformity implies less variability. Variability is mathematically represented by variance and standard deviation (the square root of variance). The exposure chamber that generates the lower standard deviation has better uniformity. Better uniformity allows for the exposure of fewer replicates. Fewer replicates that need to be collected, prepared, exposed, and analyzed lead to lower cost and reduced time in bringing products to market.

This paper aims to answer these questions using two different accelerated weathering chambers and show why better uniformity allows labs to test fewer replicates, thereby reducing costs.

### *Atlas Ci4000 Fits the Bill*

The uniformity of the three main weathering parameters at the sample surface in the Atlas Ci4000 Xenon Arc Weather-Ometer® is so superior to the Q-Panel Xe-3HS that you need several Xe-3HS units to achieve the same throughput as the Ci4000. Why? Because of the variability or non-uniformity inherent in a Xe-3HS, and the fact that the

*Continued on page 3*



**New EMMA/EMMAQUA® Suite Revolutionizes Outdoor Testing**
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## In This Issue

## AtlasCommitment to Education

*Atlas SUNTEST XLS+*

# SUNTEST Workshop Introduced in Germany

The one-day SUNTEST Workshop, which has been successfully running in the Netherlands and Switzerland for the past several years, is now being offered in Germany beginning in October 2004. For more information, contact Bruno Bentjerodt at Atlas MTT GmbH at +49-6051-707-245 or **clienteducation@atlasmtt.de**, or visit our website at **www.atlas-mts.com.**

# 2004

**SUNTEST Workshop**
October 4
Linsengericht, Germany

**Xenotest® Workshop**
October 6–7
Linsengericht, Germany

**Weather-Ometer® Workshops**

*Miami, Florida*

October 11
Ci4000/Ci5000
Weather-Ometer Workshop

October 12–13
Ci35/Ci65
Weather-Ometer Workshop

October 14
Advanced Ci35/Ci65
Weather-Ometer Workshop

*Duisburg, Germany*

November 3–4

**Fundamentals of Weathering I**

October 5
Toronto, Canada

October 19
Phoenix, Arizona

November 24
Muenster, Germany

**Fundamentals of Weathering II**

October 6
Toronto, Canada

October 20
Phoenix, Arizona

November 9, 11
India

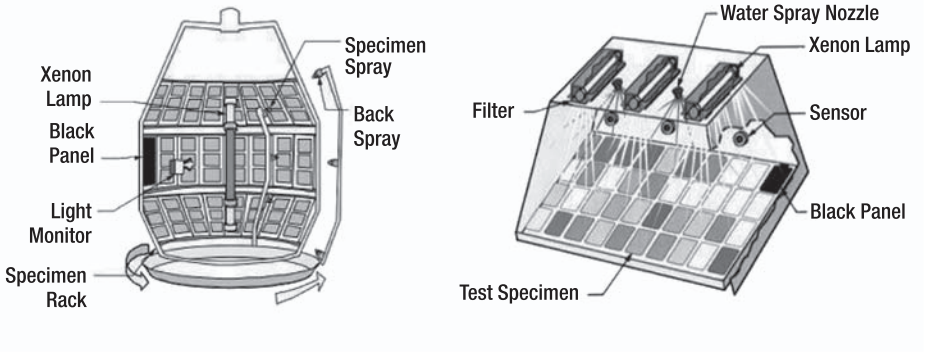
November 25
Muenster, Germany

For more information on courses in Europe, contact Atlas MTT GmbH, attention Bruno Bentjerodt, +49-6051-707-245 or clienteducation@atlasmtt.de. For more information on courses in North America, contact Theresa Schultz at +1-773-327-4520 or tschultz@atlas-mts.com. Or visit our website at www.atlas-mts.com.

See page 19 for upcoming Atlas shows and presentations!

*Uniformity, from page 1*

Ci4000 has more than twice the specimen exposure area. The Ci4000, which has at its center a single xenon source, is less variable than the Xe-3HS, which has three xenon sources, each with a separate irradiance control. Any rotating rack configuration that continuously moves the specimens within the chamber has less variability than the Xe-3HS.




In calculating the cost of exposing specimens in a laboratory-accelerated environment, one should consider exposure uniformity and specimen throughput in the calculation. As stated, the Ci4000 has more than twice the exposure area of a Xe-3HS and due to the far superior uniformity in the Ci4000, the Xe-3HS will require more replicates than needed in the Ci4000.

The purpose of exposing replicates in a laboratory-accelerated environment is to determine how the average and standard deviation of those replicates relate to the population (lot) of product that is to be sold—not merely to see the average of a number of replicates. The standard method for determining the confidence interval of the true mean from a small number of replicates is to use Student's t-table and the following equation[1]:

$$\mu = \bar{x} = \pm \frac{ts}{\sqrt{n}}$$

Where $\mu$ is defined as the confidence interval within which we can say, with a desired confidence, the true mean of our production lot lies; $\bar{x}$ (called x-bar) is the average of $n$ replicates; $s$ is the standard deviation of $n$ replicates, and $t$ is a unit-less value from the Student's t-table.

The t-table and equation are the most time-tested and easiest tools at hand to estimate the results of a small number of replicates from a production lot. Military specifications call for their use, ISO guidelines refer to them, and **ASTM G169-01 Standard Guide for Application of Basic Statistical Methods to Weathering Tests** mentions Student's t-tests in section 6.2.1 as the simplest method used to "…compare the means of two independent samples."

Now, subtract $\bar{x}$ from both sides of our familiar equation in order to get:

$$\mu - \bar{x} = \pm \frac{ts}{\sqrt{n}}$$

$\mu - \bar{x}$ allows us to compare different exposure chambers and decide the number of replicates we need to expose if we want a similar confidence interval. It tells us about uniformity of exposure inside a chamber. Moving $\bar{x}$ to the left side of the equation allows us to focus on the interval in which we can estimate, with a known degree of confidence, the true mean of our production lot. Look at the following table:

| PS Chips | Ci4000 | | | | Xe-3HS | | | |
|---|---|---|---|---|---|---|---|---|
| *n* Replicates | 6 | 5 | 4 | 3 | 6 | 5 | 4 | 3 |
| $t_{\alpha/2}$ @95% | 2.6 | 2.8 | 3.2 | 4.3 | 2.6 | 2.8 | 3.2 | 4.3 |
| s | 0.14Δb | 0.14Δb | 0.13Δb | 0.13Δb | 0.23Δb | 0.23Δb | 0.21Δb | 0.21Δb |
| $\mu - \bar{x}$ | ±0.15Δb | ±0.18Δb | ±0.21Δb | ±0.33Δb | ±0.24Δb | ±0.28Δb | ±0.34Δb | ±0.52Δb |

In this table, we see four columns for a Ci4000 and four columns for the Xe-3HS. If we look at the bottom row and left-hand column, we see that the $\mu - \bar{x}$ values vary according to

*Continued on next page*

*Uniformity, from previous page*

the number, *n*, of replicates randomly placed in the exposure area. The way we use this table is as follows: Find the sets of $\mu - \bar{x}$ values for the Ci4000, which are equal or close to the values for the Xe-3HS. Now look above those $\mu - \bar{x}$ values in the row labeled "n replicates." These are the numbers of replicates that you need to expose in an Xe-3HS in order to have the same confidence interval of the true mean for the lot you're producing as you have in the Ci4000. In this case if you choose 4 replicates in a Ci4000, you would need 6 in a Xe-3HS. If you choose 3 in a Ci4000 you would need 4 in an Xe-3HS.

The table on page 3 represents one test of one standard reference material (SRM) polystyrene chips running **SAE J1960.** While the Xe-3HS cannot officially meet the standard, the manufacturer has been implying that it does. Let's look at others:

| Orwet | Ci4000 | | | | Xe-3HS | | | |
|---|---|---|---|---|---|---|---|---|
| *n* Replicates | 6 | 5 | 4 | 3 | 6 | 5 | 4 | 3 |
| $t_{\alpha/2}$@95% | 2.6 | 2.8 | 3.2 | 4.3 | 2.6 | 2.8 | 3.2 | 4.3 |
| s | 0.69ΔE | 0.68ΔE | 0.67ΔE | 0.67ΔE | 1.60ΔE | 1.51ΔE | 1.52ΔE | 1.57ΔE |
| $\mu - \bar{x}$ | ±0.73ΔE | ±0.85ΔE | ±1.07ΔE | ±1.66ΔE | ±01.69ΔE | ±1.89ΔE | ±2.43ΔE | ±3.90ΔE |

In the table above we see that for the Orwet reference material running **ISO 4892-2:2003,** we could randomly place 3 samples in a Ci4000, but we would need 6 in an Xe-3HS in order to get the same $\mu - \bar{x}$ value and have the same confidence in our estimation of the mean of our production lot. Another example:

| Blue Wool | Ci4000 | | | | Xe-3HS | | | |
|---|---|---|---|---|---|---|---|---|
| *n* Replicates | 6 | 5 | 4 | 3 | 6 | 5 | 4 | 3 |
| $t_{\alpha/2}$@95% | 2.6 | 2.8 | 3.2 | 4.3 | 2.6 | 2.8 | 3.2 | 4.3 |
| s | 0.23ΔE | 0.24ΔE | 0.22ΔE | 0.21ΔE | 0.30ΔE | 0.29ΔE | 0.29ΔE | 0.28ΔE |
| $\mu - \bar{x}$ | ±0.24ΔE | ±0.30ΔE | ±0.35ΔE | ±0.52ΔE | ±0.32ΔE | ±0.36ΔE | ±0.46ΔE | ±0.71ΔE |

In the table above we see that for the Blue Wool SRM running **ISO 4892-2-B,** we would need to place 5 replicates randomly in an Xe-3HS to get about the same $\mu - \bar{x}$ value as 4 in a Ci4000.

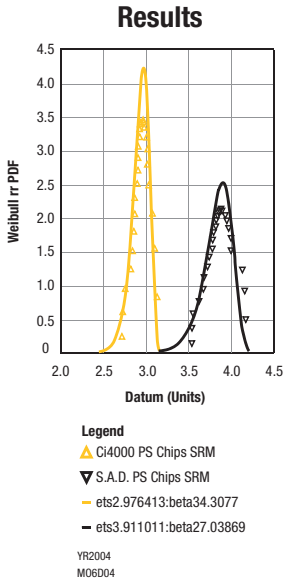
Let's look at the subject of variability (non-uniformity) in another way—curves:

Graphs 1, 2 and 3 (see next page) are Weibull[2] probability density function (PDF) curves for twenty-seven data points in each exposure chamber exposing PS Chips, Orwet, and Blue Wool SRMs, respectively (from left to right). The tall and narrow curves show the data from the Ci4000. The shorter and wider curves show the data from the Xe-3HS. As you would expect, taller and narrower curves indicate better uniformity. But there is another interesting point about these graphs. Notice that the results from the two different exposure chambers are completely different; the curves are located at different points of the x-axis. In a word, the results are not "reproducible." The results from the Atlas source and chamber, which has been supplied to the accelerated weathering market for decades, are different from the Xe-3HS. Furthermore, the results in the Ci4000 are repeatable; this is not the case for the Xe-3HS.

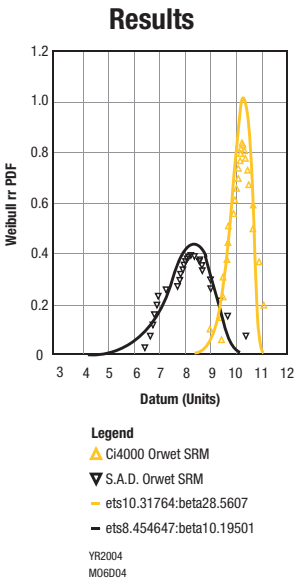
Irradiance is another factor in the superiority of the Ci4000. The 3-D chart in Figure 1 (see next page) shows the irradiance uniformity of the Ci4000 in order to compare it to the flat array of the Xe-3HS in Figure 2.

We can look at uniformity with respect to Black Panel Temperature (BPT) of the Ci4000 and the Xe-3HS as well (Figures 3 and 4).

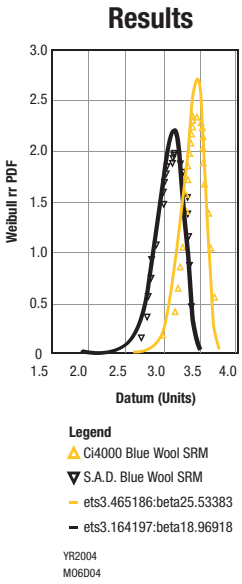
The values in these 3-D charts were measured using Atlas Xenocals and BPT sensors on the surface of the three tiers in the Ci4000 and in a grid on the surface of the Xe-3HS.




*Graph 1*




*Graph 2*




*Graph 3*

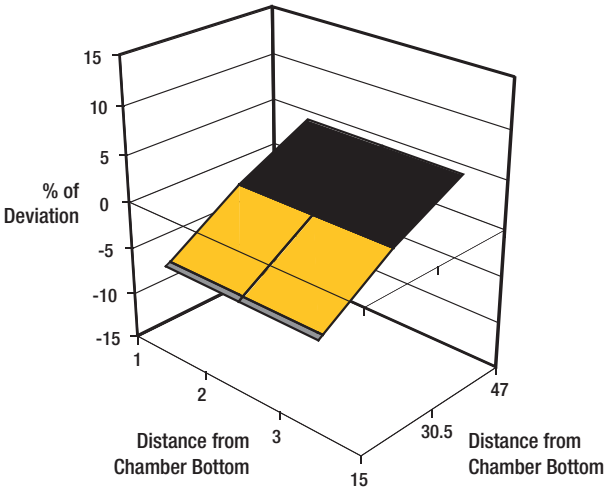



*Figure 1*

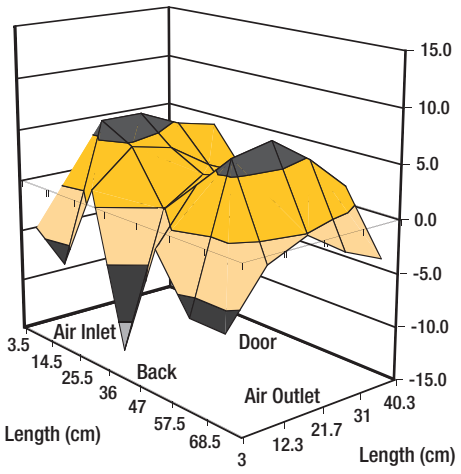



*Figure 2*

10.0–15.0
5.0–10.0
0.0–5.0
-5.0–0.0
-10.0– -5.0
-15.0– -10.0

Static flatbed with
3 lamps
E = 0.68 W/(m²nm)
at 340 nm
Maximum deviation: 10%

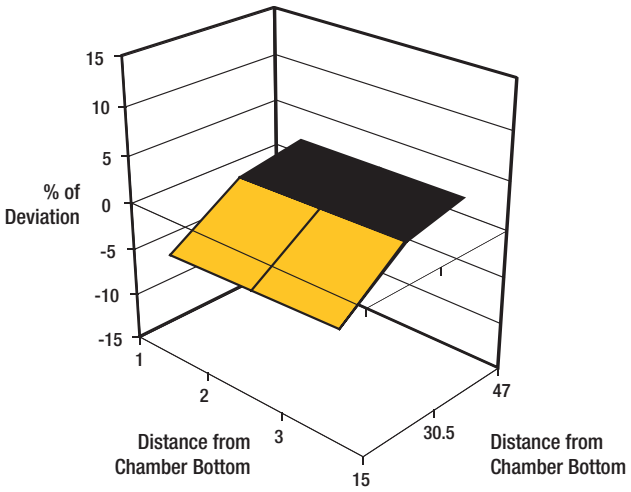



*Figure 3*

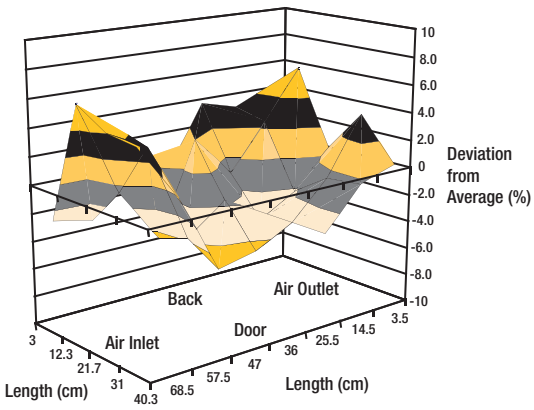



*Figure 4*

8.0–10
6.0–8.0
4.0–6.0
2.0–4.0
0–2.0
-2.0–0
-4.0– -2.0
-6.0– -4.0
-8.0– -6.0
-10.0– -8.0

*Continued on next page*

*Uniformity, from previous page*

The differences from the average values are shown in the following table in terms of percentage:

| | Ci4000 | Xe-3HS |
|---|---|---|
| Irradiance Uniformity | +1.2% to -4.6% of average | +7.0% to -12.0% of average |
| BPT Uniformity | +4.0% to -5.3% of average | +5.8 to -5.5% of average |

**ASTM G151 Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources** mentions irradiance uniformity in section 5.1.2 and requires that exposure devices must limit the lowest area of irradiance exposure to 70% of the highest area of irradiance exposure. **ISO 105 B02** (draft) reads that irradiance uniformity "shall not exceed 10% of the mean." And some portions of the Xe-3HS's exposure surface are not suitable for exposing a replicate, since those portions of the surface exceed the 10% limit.

Determining whether to buy a high-end instrument or a low-end screening device is complicated. Not only must laboratory managers take into account the cost of equipment and annual maintenance, but they must also determine the annual throughput and sophisticated testing they may need for at least five years into the future.

The following tables may help in this process:

| | One Ci4000[3] | Two Xe-3HSs | Three Xe-3HSs | Four Xe-3HSs |
|---|---|---|---|---|
| Depreciation[4] | $10,000 | $8,000 | $12,000 | $16,000 |
| Interest (12%) | $1,200 | $960 | $1,440 | $1,920 |
| Consumables | $4,700 | $5,100 | $7,700 | $10,300 |
| Utilities | $9,300 | $10,000 | $15,000 | $20,000 |
| Sample Repositioning | $0 | $400 | $600 | $800 |
| Total | $25,200 | $24,460 | $36,740 | $49,020 |

To match the throughput of one Ci4000 running **SAE J1960,** you could need as many as three Xe-3HSs. To match the throughput of one Ci4000 running **ISO 4892-2:2003,** you could need as many as four Xe-3HSs. And to match the throughput of one Ci4000 running **ISO 4892-2-B,** you could need three Xe-3HSs.

| | High Sophistication | Medium Sophistication | Low Sophistication |
|---|---|---|---|
| High Throughput | R.R.[5] | R.R. | R.R. |
| Medium Throughput | R.R. | R.R./ S.A[6] | S.A. |
| Low Throughput | R.R. | S.A. | S.A. |

## *Conclusion*

This brings us back to our original questions about how uniformity affects throughput—and ultimately cost. As previously stated, uniformity and variability are converse concepts. Exposure chambers that exhibit lower uniformity of the three main weathering parameters across the sample surface ultimately need to test more replicates to achieve accurate results. With each added replicate, companies incur unnecessary costs as the sample is collected, prepared, exposed, and analyzed. The more uniform exposure chamber requires fewer replicates and will deliver higher throughput for reduced testing costs and faster times to market.

As the pioneer and ongoing industry leader in rotating rack and static array technologies, Atlas offers a full range of weathering testing equipment and capabilities. For more information, contact a client services representative at +1-800-225-3738 or **info@atlaswsg.com,** or visit our website at **www.atlas-mts.com.** ■

## *Footnotes*

[1] This equation, developed by R. Fischer (1890–1962), can be found within the first 200 pages of any introduction to statistics text. Also, see http://mathworld.wolfram.com/Studentst-Distribution.html. Also, see page 7 of the last issue of *Sun Spots,* Spring 2004.

[2] W. Weibull (1887–1979) invented this PDF in 1937. The USAF recognized its merits and funded his research in 1975. Weibull analysis is the leading method in the world for fitting life data. (Page 1-1, "The New Weibull Handbook," 4th Edition, by Dr. Robert B Abernethy. Also see http://www.itl.nist.gov/div898/handbook/eda/section3/eda363.htm.)

[3] This comparison is based on running SAE J1960.

[4] Straight line depreciation over seven years.

[5] R.R. refers to rotating rack.

[6] S.A. refers to static array device.

# Atlas Says Goodbye to Industry Pioneer

**Dr. Dieter Kockott** joined Atlas in 1984 as a consultant and European technical director. Since that time, he has been an application specialist for Atlas products and services. Dieter brought with him a tremendous wealth of knowledge of polymer chemistry and accelerated weathering when he joined Atlas. Prior to beginning his career, Dieter studied physics and got his PhD in polymer physics from the University of Darmstadt, Germany in 1965. He had previously been with the Original Hanau Heraeus Company. At Heraeus, he was chief of R & D and spent 15 years in the development of instruments for weathering testing. Once at Atlas, Dieter collaborated with leaders in industry in global standards bodies, technical conferences, and symposia to keep Atlas on track with the growing needs in accelerated weathering testing. A great believer in new technology and innovation, he has always worked to continually improve test methods to better simulate materials' end use and to standardize global norms. He has been a prodigious contributor to many standards committees as a member of DIN (German Institute for Normalization) for the testing of textiles, plastics, and paints: ASTM committees D01 (paints) and G03 (weathering and durability); ISO/TC61 (plastics); SC6/WG2 (light exposure) for which he was chairman from 1976–1982; ISO/TC35 (paints); and ISO SC9/WG26 for performance testing for which he was a foundation member and the chairman from 1984–2004.

Dieter led the way in opening the European test specifications to include water cooled xenon instruments. In Atlas R & D, he was instrumental in the product design and performance specifications for the Ci3000 Weather-Ometer and Ci3000 Fade-Ometer. Dieter continued to be active in advancing weathering techniques with research and design work on projects that included modeling, chemiluminescence, and CESORA (Calculation of Effective Solar Radiation).

Dieter's intellectual and practical understanding of materials coupled with his love of science have kept him in high regard with his colleagues and peers. An excellent collaborator, Dieter has been a key figure at the podium and on the organizing boards of many global scientific and technical symposia on the topics of materials and weathering science. As a member of the founding faculty, Dieter was integral in the development of the curriculum for the Atlas School for Natural and Accelerated Weathering (ASNAW). For Dieter, teaching the science of accelerated weathering was as simple as explaining the difference between incubating the egg of a chicken and frying that same egg.

Over the years, he has authored and co-authored many articles dealing with weathering of organic materials and new test methods.

At home, Dieter has an equally energetic collaborator in his wife Annemarie. Together their curiosity and love of learning know no bounds. They have two grown children. Their daughter Irene lives in Steinheim. Their son Lutz and his wife have a daughter and a son and live in Brazil, where Lutz works as an engineer. When they are not travelling to Brazil to visit their grandchildren, Dieter and Annemarie enjoy the quiet beauty of their vacation home in the mountains in eastern Germany about 100 km from Frankfurt.

His many friends and colleagues throughout the Atlas organization extend to Dieter congratulations on his successful career and wish him a very happy retirement filled with family, friends, classical music and lots of cookies! Thank you, Dieter, for sharing with us your brilliant mind and wonderful sense of humor. ■

# Simulation Lab Testing Now Available for Large Components

Responding to increased demand, Atlas Weathering Services Group (AWSG) has expanded its current offering in the United States to include solar simulation laboratory testing of large components. Previously handled by the AWSG sites in Lochem, The Netherlands, and Duisburg, Germany, this service is increasingly requested due to the globalization of automotive standards, specifically the need to meet DIN 75220. The Atlas SC2000 Solar Simulation Chamber is now available to customers at AWSG's full service materials testing and evaluation laboratory in Miami, Florida (South Florida Test Service).

The Atlas SC2000, part of the SolarClimatic Series, is a full-function climatic chamber that utilizes a metal halide light source to generate the energy of simulated global radiation, creating an effect that reproduces the spectrum of select indoor and outdoor environments. A 3400-liter test chamber can accommodate products of a wide range of sizes. Components with large surface areas such as airbag units or even complete large-scale components such as instrument panels can be tested in the spacious chamber. In fact, because it was specially designed to match the requirements of simulated environmental tests with solar radiation, the Atlas SC2000 can be used for myriad applications, including chemicals, electronics, photovoltaic units, roofing panels, military and aerospace materials, window units, and especially automotive components.

*Atlas SC2000 interior*

High performance features provide flexibility in test specifications to accommodate customers' individual needs. With a temperature range of -40 to 120 °C and a relative humidity span of 10 to 90%, the SC2000 can determine the resistance of large-scale components to a wide variety of environmental conditions.

Though it has many potential uses, the Atlas SC2000 has proven to be invaluable within the automotive industry, as shown for many years in Europe. Due to increased standards, automotive companies in the United States require an efficient, convenient, and economic method for accelerated solar simulation tests for large components, and AWSG is now equipped to provide that service.

Other tests performed with the Atlas SC2000 include DIN 75220, ISO 9022-9, and ISO 12097-2. The machine is extremely helpful in identifying material performance problems by replicating the current climatic conditions and testing potential solutions within a fixed environment. The SC2000 is also the optimal solution for companies that currently test large components with the AWSG's

Instrument Panel/Door Panel (IP/DP) Box in accordance with such standards as GM9138P, yet need quicker results under set parameters.

For more information about AWSG's expanded offering, visit our website at **www.atlaswsg.com.** Or you can contact a client services representative at +1-800-225-3738 or **info@atlaswsg.com.** For further information about the Atlas SC2000, a Technical Bulletin is available on our website at **www.atlas-mts.com.** ■

# Atlas Supports Carbon Arc Testing


Enclosed carbon arc was first introduced in Atlas equipment in 1918. As materials with greater durability were introduced, demand grew for a light source that would provide a better spectral match to sunlight. In 1934 Atlas developed Open Flame Sunshine carbon arc. Even with this development, carbon arc testing was not providing adequate correlation for many materials. In addition, carbon arc technology was labor intensive and dirty. Atlas continued to pave the way in laboratory accelerated weathering by developing weathering instruments with both fluorescent and xenon light sources.

During this transition from carbon arc to xenon arc light sources, Atlas has continued to provide consumables for many of our carbon arc instruments. While we believe that weathering technology has improved with the use of xenon long arc lamps in Weather-Ometers, we understand that some of our customers either choose to perform carbon arc testing due to their long history or are required to meet certain industry standards.

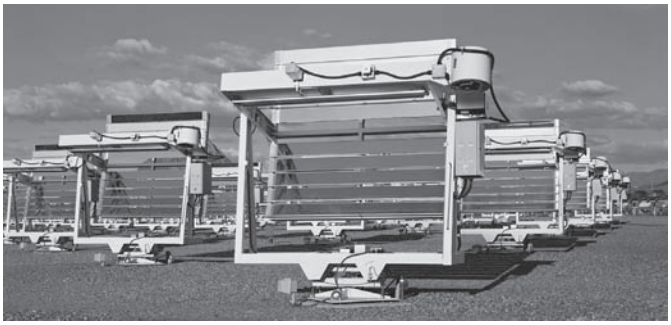
Atlas is committed to supporting our installed base of carbon arc instruments with parts and supplies as long as we are able to obtain them from our suppliers. Some of the technology used in the carbon arc instruments is getting very dated and difficult to source. However, Atlas will do whatever is possible and feasible to support this equipment. Please be sure to contact an Atlas customer service representative for current pricing and availability.

If you are finding it difficult to maintain your carbon arc instruments or the volume of testing does not warrant such support, Atlas Weathering Services Group provides a great alternative. Our fully equipped accelerated weathering laboratories in Miami, Florida; Duisburg, Germany; and Oxford, UK are ready to serve your needs with both carbon arc and xenon arc Weather-Ometers. The Atlas laboratory is equipped to test your products to a variety of global testing standards. For more information, visit us at **www.atlas-mts.com** or contact your local sales representative. ■

# New EMMA/EMMAQUA® Suite Revolutionizes Outdoor Testing

Four test services recently introduced by Atlas Weathering Services Group have brought outdoor accelerated testing to a higher level.

With the addition of pioneering outdoor accelerated temperature and irradiance controls, Atlas' new EMMA/EMMAQUA® services now produce the most accurate results in the industry. The patented systems—which were field-tested for over a year—may be used independently or in various combinations to enhance accuracy and test products that previously could not be tested in an outdoor accelerated environment.



"Our customers would never buy an accelerated laboratory weathering instrument without temperature control," said Jack Martin, President of Atlas Weathering Service Group. "Now we can manage sample temperatures on EMMAQUA, resulting in more accurate testing. This breakthrough also allows us to test materials that are sensitive to thermal buildup, such as dark-colored, heat-sensitive thermoplastics."

The four new systems are the Static Temperature Controlled EMMA/EMMAQUA, the Night Temperature Controlled EMMA/EMMAQUA, the Dynamic Temperature Controlled EMMA/EMMAQUA, and the Variable Irradiance EMMA/EMMAQUA. Here's how each works:

## Static Temperature Controlled EMMA and EMMAQUA

In the Atlas-patented Static Temperature Controlled EMMA/EMMAQUA, a black-panel temperature sensor mounted in the exposure target area or a thermocouple imbedded in an actual test sample interfaces with a variable-speed blower motor. The blower circulates cooling, ambient air across the test specimens. An operator programs the predetermined temperature into a controller, which speeds up the blower if the sensor is hotter than the set temperature and slows it down if the sensor is colder than the set temperature.

The Static Temperature system greatly reduces temperature intermittency effects caused by clouds as well as by starting tests at different times of year (winter vs. summer). It can also maintain consistent sample temperatures through cool morning and late-afternoon temperatures.

## Night Temperature Controlled EMMA and EMMAQUA

In the Night Temperature Controlled EMMA/EMMAQUA, special heater platens are mounted behind specimens on the target area and connected to a timer that turns on at night and off in the morning. The specimens receive radiant, convective, and conductive heating through the unexposed side. Customers can specify the time, duration, and set temperature of the heating platens.

The Night Temperature Controlled system acts like an electric blanket, counteracting the heat absorbing power of the night desert sky and low winter nighttime sample temperatures on the standard EMMA and EMMAQUA. It can also approximate summer nighttime temperatures during winter exposures for some materials and can help overcome the effects of starting tests at different times of year (winter vs. summer).

## Dynamic Temperature Controlled EMMA and EMMAQUA

The Atlas-patented Dynamic Temperature Controlled system simulates the intermittent temperature patterns found in natural exposures on an accelerated exposure. A remotely located temperature sensor establishes the "set point" for the controller. The controller compares the temperature sensor on the target exposure area with the remote reference temperature sensor and adjusts the cooling blower speed until the target sensor temperature equals the remote sensor temperature.

The remote sensor can be installed in a static exposure near the EMMA, such as a car hood, a roof section, or simply a piece of material in a static rack. The remote sensor changes with the environmental patterns of the day, and these patterns are duplicated on the EMMA target area.

The remote sensor can also be mounted on an adjacent EMMA to thermally link devices in a "chain" or "daisy" configuration for designed experiments or enhanced temperature repeatability. A temperature offset can be inserted in the controller so the target temperature can be hotter by a specified amount and still duplicate the temperature pattern of the environment. Remote temperature sensor configurations may include black panels, end use materials on exposure racks, and even some full-scale installations—a car, for example. Target area temperature sensors can be mounted as standard black panels or even embedded within customer-specified materials.

## Variable Irradiance EMMA and EMMAQUA

The Variable Irradiance EMMA/EMMAQUA uses Atlas-pioneered mirror solar concentrator technology to better control irradiance. Between two and 10 mirrors can be installed, depending on the exposure requirements of the customer and the material. The number of mirrors may be changed at different times of year—i.e., more mirrors during colder winter exposure and fewer mirrors during hotter summer exposure. The variation in solar concentration allows temperature-sensitive materials such as thermoplastics to be successfully exposed.

A Static or Dynamic Temperature Controlled system is typically used in conjunction with this system for temperature compensation and finer control.

The Variable Irradiance system:

- allows temperature sensitive materials such as dark colored thermoplastics to utilize EMMA exposures at different levels of acceleration,
- allows investigation of effects from different solar irradiance and temperature levels,
- allows investigation of a material's reciprocity characteristics,
- maintains natural intermittent patterns of light and temperature while varying light and temperature levels, and
- can be used for very sophisticated and controlled weathering experiment design.

## Special Offer

SAVE Today!

For a limited time, the four new services will be offered at the same price as existing EMMA and EMMAQUA testing. For more information, contact an Atlas client services representative at +1-623-456-7356 or visit **www.atlaswsg.com.** ■

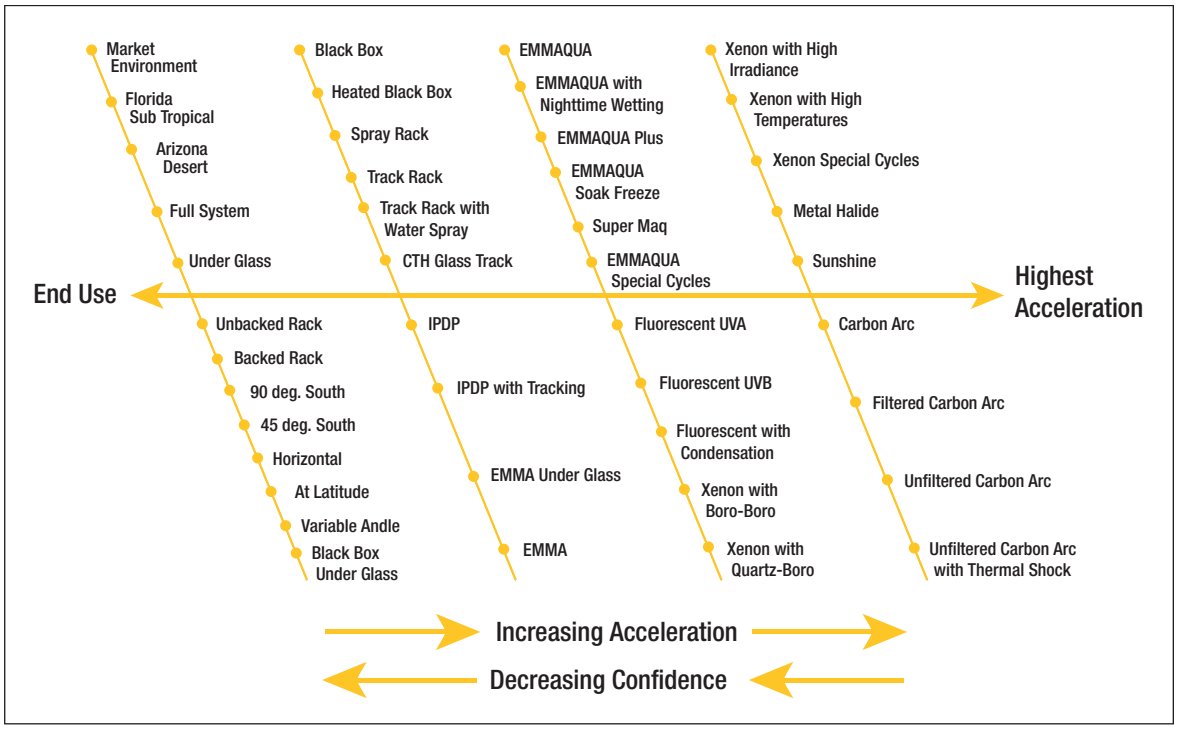
## AtlasCommitment to Growth

# Weathering Experimenter's Toolbox: Test Method Continuum

Organizing the scope of weathering test methods into logical order helps the engineer visualize tools available for weathering tests. The figure below presents one such organization. In general, there appears to be a trade-off between confidence and acceleration of test methods. Between specific methods and materials, however, this trade-off becomes less obvious.

### *Avoid Putting Eggs in One Basket*

As in a 401K program, where diversification of investments lowers risk, relying on several test methods rather than a single method provides robust results. Initiating several smaller tests along different points of the testing continuum, rather than in one large complex test program using a single methodology, reduces testing risk and does not put all the eggs in one basket. Comparisons between several test methods and multiple replicates within methods also result in a higher level of information. ■



# Atlas Ci3000+ Approved by Marks & Spencer

## Accreditation Proves Quality and Value of Mid-Priced Lightfastness Testing Instrument

The Atlas Ci3000+ Xenon Arc Weather-Ometer® and Fade-Ometer® testing instruments have been accepted for lightfastness testing by Marks & Spencer, a prominent retail organization with over 600 stores worldwide.


*The Atlas Ci3000+*

Using the Atlas Ci3000+, manufacturers can establish colorfastness-to-light qualifications for fabrics, buttons, and other similar substrates in order to meet Marks & Spencer's rigorous quality standards.

PPT, an independent laboratory accredited by Marks & Spencer, recently performed detailed tests to evaluate the Ci3000+'s performance. Comparisons were made between the Ci3000+ and two other Atlas instruments—the XENOTEST® Alpha and the 150 S+, which are the current testing instruments required by Marks & Spencer standards.

The outcome of the tests was excellent. PPT reported that the results achieved by the Ci3000+ were identical to those obtained from the Alpha and the 150 S+.

Upon completing the tests, Marks & Spencer recognized the Ci3000+ as a fully capable lightfastness instrument that can be used as a valid alternative to the Alpha or the 150 S+.

The Ci3000+ Xenon Arc Weather-Ometer is the perfect balance of price and performance for accelerated weathering and lightfastness testing. Featuring a state-of-the-art temperature control system, the Ci3000+ exceeds today's tough performance standards while providing accurate, reproducible, and repeatable test results.

Offering the most advanced testing features available in a smaller-capacity instrument, the Ci3000+ is an economical solution that meets both testing and budget requirements for leading companies worldwide.

For more information about the Atlas Ci3000+ Weather-Ometer, contact a sales representative at +1-773-327-4520 or **info@atlas-mts.com.** ■

## AtlasTest Instruments Group

# UV2000 Ideal for Woven Sacks in India

Production of technical textiles such as woven sacks, jumbo bags, and tarpaulins is on the rise, particularly in India. Commonly called FIBCs (flexible intermediate bulk containers), these woven polypropylene containers are designed to hold large quantities of a product, from 500 to 2000 kg. Each year over 25 million FIBCs are sold in Europe alone to a wide range of industries including building and aggregates, chemical, pharmaceutical, and food products.

With the increase in FIBC production, manufacturers in India are working to develop suitable testing procedures. Accelerated laboratory weathering testing is the best way to determine the degree of degradation of mechanical properties during natural long-term weathering. UV test data can assist in the selection of new materials, the improvement of existing materials, and the evaluation of how changes in formulations affect product durability. The main standards in this field refer to fluorescent UV condensation type devices.


The outcome of the UV test is reported as the percentage residual tensile strength of the fabric after UV exposure compared with the unexposed fabric. The acceptance protocol requires that samples retain at least 50% of the original tensile strength value.

The Atlas UV2000 is one of the best devices on the market for this kind of testing. It reproduces the damage caused by sunlight, temperature, and water, where options include direct water spray, condensation, or both.

Samples within the UV2000 are exposed to alternating cycles of UV light and moisture at controlled, elevated temperatures. Within six to nine days, the UV2000 simulates the results that occur over months of outdoor exposure under natural conditions. Typical types of damage include fading, loss of gloss, loss of strength, and oxidation.

The UV2000 has innovative design features that improve test reproducibility and lower operating cost. It also meets many international and national standards for accelerated UV weathering tests of FIBCs, including:

**EN 277: 2001—**sacks for transport of food aid; sacks made of polypropylene fabric
**EN 1898: 2000—**Standard for FIBCs for Non Dangerous Goods
**ASTM G154-98—**Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Non-Metallic Materials
**ASTM D4355—**Standard Test Method for Deterioration of Geotextiles From Exposure to Ultraviolet Light and Water (xenon-arc type apparatus)
**Indian standards:**
**IS 14887:2000—**textiles, high density polyethylene/polypropylene woven sacks for packing 50/25 kg food grains
**IS 14968:2001—**textiles, high density polyethylene/polypropylene woven sacks for packaging 50/25 kg sugar
**IS 9755:2003—**textiles, high-density polyethylene/polypropylene woven sacks for packaging fertilizers

For more information, contact your local sales representative or visit **www.atlas-mts.com.** ■

# Atlas Flatbed SUNTEST Gets Even Bigger

Atlas Material Testing Technology proudly introduces the SUNTEST XXL/XXL+—the largest member of the flat-array SUNTEST family—delivering better irradiance uniformity and test parameter control than any flat-array screening device in the world. Providing best-in-class performance at an affordable price, the XXL/XXL+ is the latest iteration of nearly 30 years of research and design of the SUNTEST product line.

Developed by experts in solar spectrum simulation, the new SUNTEST XXL/XXL+ uses special lamps specifically designed for weathering testing. These advanced, long-arc xenon lamps are the best available method of simulating natural sunlight and deliver the most uniform, consistent irradiance in flat-array weathering instruments today.

*The new SUNTEST XXL+*

Other manufacturers' devices are typically equipped with simple xenon lamps like those found in ordinary photocopy machines. These low-quality lamps often cause irradiance spikes, which can have unnatural weathering effects on test materials and skew the results.

The new Atlas SUNTEST, which comes in two versions—with specimen spray (XXL+) and without specimen spray (XXL)—offers the following benefits over other flat array devices:

- Superior xenon lamps
- Superior exposure uniformity
- Reliable, valid testing results
- Unmatched capacity to handle large objects or numerous test panels
- Easy access to the testing chamber
- Simple programming with touch-screen interface
- Built-in memory chip interface, allowing users to upload test programs
- Competitive price

With its extra large 3000 $cm^2$ exposure area, the SUNTEST XXL allows users to test more samples at the same time. Large three-dimensional samples like bottles, assembled components, and completed products can be tested with accurate xenon light.

For more information about the Atlas SUNTEST XXL, contact a sales representative by phone at +1-773-327-4520 or **info@atlas-mts.com.** You can also visit the Atlas website at **www.atlas-mts.com/xxl.** ■

# Atlas Unveils New and Improved CCX Corrosion Cabinet

Atlas has upgraded its CCX Corrosion Cabinet for laboratory testing with greater extremes of temperature and more ways to replicate climatic stresses than any other cabinet in the market.

## Temperature Extremes

There are two options for testing at temperatures as low as -30 °C: LN2 Freezing/Cooling and Mechanical Refrigeration. When either system is ordered, additional insulation is placed around the exposure zone. Each has different advantages for the lab:

**LN2 Freezing/Cooling**

- Lower initial cost and RH
- Smaller floor area
- Lower shipping cost
- Shorter lead time
- Less maintenance time

**Mechanical Refrigeration**

- Superior control of temperature and RH
- Lower cost to operate
- Longer periods at freezing temperature

At the other extreme for corrosion testing, Atlas offers the Very High Temp 90 °C option that allows engineers and chemists to test materials as high as 90 °C. When using high temperature, it becomes necessary to use different materials for other options that are installed in the exposure zone. Therefore, there are "high temp" versions of the Solution Spray and Automatic Retractable RH Probe options.

*The enhanced CCX Corrosion Cabinet gives you a competitive edge.*

## Multiple Climatic Stresses

A CCX can deliver moisture—one of the principal components of weathering that causes material degradation—to a sample surface in a variety of ways:

- Condensing Fog, Electrolyte
- Condensing Fog, DI Water
- Direct Spray, Electrolyte, or DI Water
- Condensing Fog, Second Electrolyte
- Non-Condensing, High RH DI Water
- Immersion

Perhaps more importantly, the RH can be varied when a CCX is running with Condensing Fog, DI Water. It is well known that more degradation takes places during transition times between wet and dry than when a material is constantly wet or dry. With the Adjustable RH option, a CCX can prolong those transition times, accelerating the damage from moisture.

Further, an Atlas CCX can be equipped with a Gas Injection System, which allows testing in simulated polluted atmospheres. Typical gases for lab testing in corrosion cabinets include $SO_2$, $CO_2$, and $NO_X$.

## The Basics

The Atlas CCX comes in five standard sizes:

- 20 cu ft/565 litres
- 30 cu ft/850 litres
- 40 cu ft/1130 litres
- 90 cu ft/2550 litres
- 110 cu ft/3115 litres

## Custom Designs

Atlas can build a CCX cabinet to almost any specification or size. Cabinets have even been designed to put electrical and mechanical power inside the exposure zone. Other custom designs include cabinets to hold large cylinders (1.7m/5′7″ H) of compressed gas mounted upright, operating windshield wiper motors, automotive lighting systems, belt-driven alternators with recorded electrical output, and complete automotive cooling systems under load with pressure and temperature monitoring.

## Ultimate Goal of Testing

The Atlas CCX is designed to help our customers achieve a quality product, a competitive edge, and a faster time to market. A CCX with almost any combination of the testing options described herein can be found in labs of leading automotive manufacturers, steel producers, government agencies, paint manufacturers, and military organizations around the world.

Described options are primarily for conformance to published or custom test specifications. Other options listed in our price bulletin are for operator convenience, improvements in efficiency, installation requirements and site conditions, company requirements, or future testing needs.

With its "backward compatible" design that allows it to perform most Traditional Salt Fog and Humidity Test and Basic Cyclic Corrosion Tests as well as cutting-edge Advanced Corrosion Tests, the Atlas CCX is the most versatile corrosion testing cabinet ever designed. And there are more improvements on the way. Stay tuned! ■

*Look for us at Booth #10/C23!*

# K'Show Spotlights Vision, Innovation

The K'Show is the world's number one fair for plastics and rubber technology, a trademark that has been synonymous for over 50 years with groundbreaking innovations and sneak previews of industry developments. The show will be held at the Duesseldorf Trade Fair Centre in Duesseldorf, Germany, October 20–27.

Atlas plans to exhibit its full range of weathering instruments:

- The XENOTEST® Beta+, a well-known instrument with years of service in the test laboratories of the plastics industry, as well as in the automotive, packaging, textile, and pharmaceutical industries. The Beta+ now features a modified design and an even more user-friendly touch screen control.
- The UV2000—the most affordable, easy-to-use fluorescent weathering device with controlled irradiance.
- The brand new SUNTEST XXL/XXL+, Altas' largest flatbed SUNTEST instrument, introduced in September. Providing best-in-class performance at an affordable price, the SUNTEST XXL/XXL+ is the latest iteration of nearly 30 years of research and design of the SUNTEST product line. (See page 15 for details.)

K2004
International Trade Fair

Customers visiting the Atlas booth at the K will have the opportunity to participate in one of a dozen 90-minute XXL product showcases. For details, contact **marketing@atlasmtt.de.** ■

## Atlas Test Instruments Group

# Atlas HVFAA is Best Source for Flammability Testing

*Atlas HVFAA Horizontal Vertical Flame Chamber*

With newly expanded capabilities, the Atlas HVFAA Horizontal Vertical Flame Chamber is the optimal instrument for conducting FAA flammability tests. The HVFAA provides the most accurate and repeatable means for determining the flammability of aircraft cabin and cargo materials, including liners, waste storage compartment materials, electric wire, and others.

The US Federal Aviation Administration (FAA) has approved the HVFAA for technical competence in flammability testing for aircraft materials. With the HVFAA, Atlas now offers one instrument that meets the requirements of all FAA Bunsen Burner Tests as regulated in the Aircraft Material Fire Test Handbook (FAR 25.853, 25.855, and 25.1359), as well as additional flammability testing requirements within this field.

Through advanced technology, the HVFAA functions as a large-volume, draft-free test chamber and prevents oxygen depletion within the unit to ensure test accuracy and repeatability. With this higher volume chamber, the HVFAA can be used for an extensive range of testing that previously would have required more than one instrument.

The HVFAA Horizontal Vertical Flame Chamber is easy to use with a simple bench top design, tilting burner mount, and sliding tempered-glass viewing window. Three digital timers with remote control make specimen event timing both precise and convenient. Hand access ports enable operators to safely manipulate burner positioning without interfering with the testing process. To ensure accurate and safe gas control, the HVFAA is equipped with a precision flowmeter and gas pressure regulator. A special gauge activates an automatic gas shutdown feature in the event of an emergency or power failure.

To meet a broad range of flammability testing needs, as many as four easily interchangeable specimen holders are available. An optional flame confirmation kit verifies test flame height and color and provides further assurance that test results are reliable and repeatable.

For more information about the HVFAA or other flammability testing instruments, visit our website at **www.atlas-mts.com**. For pricing and availability, contact a client services representative at +1-773-327-4520 or **info@atlas-mts.com.** ■

## AtlasSpeaks

# 2004

**TEST EXPO**
October 29
Novi, Michigan

Jay Lipscomb, Product Manager for Atlas Weathering Instrumentations Products, will present a paper titled "Uniformity in an Accelerated Weathering Laboratory Chamber: How Should It Be Defined?"

# 2005

**Symposium on International Automotive Technology**
January 19–22
ARAI Institute
Pune, India

Cees van Teylingen, Product Specialist, Atlas Material Testing Technology BV, will present a paper on "New Developments in Accelerated Light Fastness/Weathering Methods in the Automotive Industry."

Andreas Kuehlen, General Manager of K.H. Steuernagel GmbH, will present a paper on "CESORA – Calculation of Solar Radiation Parameters in the Business of Material Testing" and "Efficient Lighting Systems for High-Speed Imaging on Vehicle Safety Test Applications."

**Chicago Society of Coatings Technology**
March 2
Chicago, Illinois

Al Zielnik, Director of Strategic Sales, Atlas Material Testing Technology, will teach a short course on Weathering Durability.

## AtlasShows

# 2004

**CHEMTEC PRAHA 2004**
October 6–7
Praha, Czech Republic

**K'Show 2004**
October 20–27
Duesseldorf, Germany
Booth #10/C23
*(see page 17 for details)*

**FSCT ICE 2004**
October 27–29
McCormick Place
Chicago, Illinois
Booth #418

**TEST EXPO North America 2004**
October 27–29
Detroit, Michigan
Booth #2044

**IFAI 2004**
October 27–29
Pittsburgh, Pennsylvania
Booth #2438

**HET INSTRUMENT**
November 1–5
Utrecht, The Netherlands

**AISEX 04**
November 18–20
Colombo, Sri Lanka

**ITME 2004**
December 4–11
Mumbai, India

# 2005

**SAE 2005**
April 11–14
Cobo Center
Detroit, Michigan

**European Coatings Show**
April 26–28
Nuremberg, Germany

**Interplas**
October 4–6
Birmingham, UK

**Fakuma**
October 18–22
Friedrichshafen, Germany

**Expoquimia**
November 14–18
Barcelona, Spain

***For the latest on Atlas shows and presentations, visit www.atlas-mts.com.***

SunSpots

Would you prefer to receive Sun Spots via e-mail rather than in print?

If so, please fill in your name and company and fax this page to Jamie Chesler at Atlas, +1-773-327-4023.

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