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SunSpots®

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Defending Wood Coatings from the Sun

Optimised Use of UV Absorbers and HALS in the Weathering Protection of Wood Substrates

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Ciba Inc., Basel, Switzerland

A major drawback in the use of wood materials for construction and decorative applications is its sensitivity to light. Coatings are usually used to prevent deterioration of the wood surface. The protection effect depends greatly on the opacity of the coatings; low-opacity coatings, which transmit the most radiation, are less effective. However, optimised use of UV absorbers and HALS, both in the coating system and also in a direct wood impregnation step, can improve the light stability considerably.

The popularity of natural wood as an exterior design and construction material would be even greater if significant improvements could be achieved in extending its durability with reduced maintenance work. But under outdoor conditions, weathering causes deterioration of the surface, due to a complex set of reactions induced by such factors as solar radiation, water, temperature, and oxygen.

How Light Degrades Wood

Many researchers have shown that ultraviolet (UV) and elements of the visible (VIS) spectrum of solar radiation cause most of the chemical modification and mechanical breakdown of exposed wood. To understand these effects, it is important to understand wood biology and the related mechanisms of photo-oxidation and degradation.

Chemically, wood is a complex biopolymer composed of structural polysaccharides, essentially cellulose as a structural substance, hemicelluloses as a kind of glue, and lignin as strength provider. Lignin contains chromophores with aromatic conjugated bond systems and carbonyl groups, and this is why its interaction with light (UV/VIS) in the presence of oxygen is the main cause of wood photo-oxidation.

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Bandung Jawa Barat, Indonesia

Qingdao International Textile Machinery Fair
April 8–10
Guangzhou, China

PlastImagen Mexico 2008
April 8–11
Mexico City, Mexico

SaigonTex
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Ho Chi Minh, Vietnam

Easy Fairs Plastic
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Coatings for Plastics
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Solar Power 2008
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San Diego, California, USA
Booth 728

FAKUMA
October 14–18
Friedrichschafen, Germany

Expoquimia
October 20–24
Barcelona, Spain

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

AtlasSpeaks

2008

Detroit Society for Coatings Technology
April 8 • Detroit, Michigan, USA

Allen Zielnik, Senior Consultant, Weathering Science, will present "Weathering Testing of Coatings—Some Lessons Learned."

11th Annual International Coatings for Plastics Symposium
April 21–23 • Chicago, Illinois, USA

Allen Zielnik, Senior Consultant, Weathering Science, will present "Weatherability Testing of Plastics—Some Things We've Learned in the Past 85 Years."

ESTECH 2008
May 5 • Indian Lakes Resort, Bloomingdale, Illinois, USA

Allen Zielnik and George Coonley will present "Will it Last? Effective Solar and Environmental Strategies and Tools."

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The lignin undergoes chemical modifications resulting in radical formation and finally decomposition, producing coloured and hydrophilic byproducts. The resulting surface property changes lead to discolouration and increased water sensitivity followed by hydrolysis, leaching of the chromophores, and finally erosion and greying of the wood. Today, the photo-oxidation of lignin is well understood, and at least four degradation pathways have been identified [1].

The key to increasing the service life of wood with film-forming finishes is the optimisation of light protection of the wood surface and the coating. Since the early 1970s, it has therefore been common practice to combine UV absorbers (UVA) with hindered amine light stabilizers (HALS).

The Chemistry of HALS and UVA

HALS are mainly derivatives of 2,2,6,6-tetramethylpiperidine and help to prevent surface defects such as gloss loss, chalking in pigmented systems, and cracking in clear coats. Figure 1 shows the chemical structures of some commercial UVA and HALS products.

The most important HALS compounds are difunctional piperidine derivatives, as shown in Figure 1. Here the substituent on the nitrogen atom determines the properties of the HALS due to basicity. For instance, HALS-1 with R = CH_3 is basic (pKb ~ 5) and interferes with acid-catalysed and some air-drying alkyd systems. Therefore, the non-basic aminoether function N-OR—e.g., HALS-2 with R = OC_8H_{17} (its pKb of ~ 10 denotes a much weaker base)—has gained wide acceptance in the paint industry, as it has the major advantage of non-interaction with biocides, acidic media, and the drying process of acid-catalysed or air-drying systems.

In contrast to HALS, which trap radicals at the surface, UVA filter out the harmful wavelengths of the light spectrum before photochemical reactions can take place, and therefore reduce the rate of radical generation [2]. Today, UVA based on 2-(2-hydroxy-phenyl)-benzotriazole (BTZ) chemistry are considered to be the most important class for the stabilisation of clear coats. Commonly used UVA are BTZ-1 for solventborne and BTZ-2 for waterborne applications.

Some limitations of benzotriazole-based UVA have pushed the paint industry to adopt a new UVA class based on 2-hydroxyphenyl-s-triazine (HPT) chemistry [3]. This new class of UVA can be fine-tuned by selective choice of substituent, allowing tailor-made additives to be created for powder [4], high performance automotive, industrial, and wood coating applications [5].

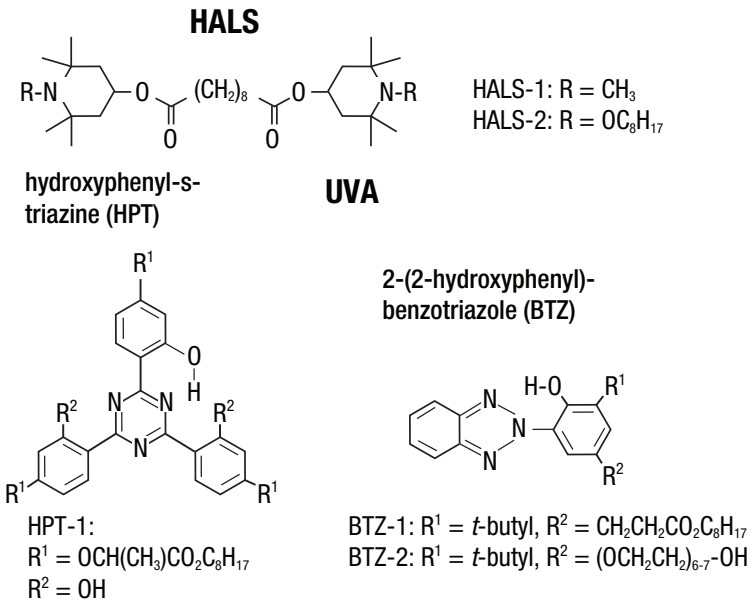

FIGURE 1: Chemical structure of some commercial UVA and HALS products

For wood, a UVA based on substituted tris-resorcinol triazine (Figure 1, HPT-1) with exceptional photo-permanence and a more pronounced red-shifted absorption was introduced for UV curable systems [6], for high performance solventborne [7, 8], and, in encapsulated form, for waterborne wood coating applications [9, 10].

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Direct Wood Pretreatment Based on Special HALS

As both UV and visible light up to 500 nm causes lignin degradation [11], wood has to be protected from parts of the visible light spectrum. Therefore, a new two-step protection strategy was introduced, in which a lignin stabiliser is applied as a dilute pre-treatment solution or in an existing primer formulation directly onto wood and selected UVA (for indoor applications) or UVA/HALS (for outdoors) are used either in the same treatment stage (internal UV filter effect) or preferably in a subsequently applied top coat (external filter effect).

Such lignin-stabilising treatments, which improve colour stability in interior applications and long-term durability in low-opacity exterior wood coatings [12], are based on a special HALS. The HALS traps the radicals formed by visible light at the wood surface, which have not been screened by organic UVA (> 400 nm) [13, 14]. This approach finally allows the use of clear or low-pigmented coatings even in high-performance, high-durability outdoor applications—e.g., wooden window frames.

Most of the paints used today are semi-transparent finishes, where the pigments may act as partial VIS light protectors. This protection can be increased through a combination of organic UVA for substrate protection and HALS for coating protection as well as the lignin stabiliser. It is well known that such combinations of organic and inorganic UV/VIS light screeners show good performance in certain ratios.

The knowledge of how to use this two-step protection strategy is still limited and has to be improved to obtain efficient and economic use of light stabilisers for film-forming wood coating systems according to the shade of the coating, i.e., the degree of pigmentation. It is evident that clear, semi-transparent, and opaque coatings behave differently during weathering and therefore require different light stabiliser packages.

Experimental

The effectiveness of various light-protective treatments was evaluated using the following conditions:

- **Wood Samples:** Pine (pinus radiata) 200 mm x 90 mm x 10 mm with back- and end-grain sealing with an automotive 2K-PUR clear coat

- **Paint System:** Linseed long oil alkyd (LOA) with different amounts of transparent black, red, and yellow iron oxides plus a white pigmented system (2 x 120 g/m^2 applied by brush)

- **Stabilisers:** HPT-1 as UVA, HALS-2 (decanedioic acid, bis(2,2,6,6-tetramethyl-1-(octyloxy)-4-piperidinyl) ester) and a lignin stabiliser pre-treatment (2% aqueous solution; 1 x 80 g/m^2 brush applied)

- **Artificial Weathering:** Atlas Ci65A Weather-Ometer®, Xenon light according to the Xe-WOM CAM 7 cycle for exterior applications (inner and outer borosilicate filter) according to DIN EN ISO 11341 A (0.35 W/m^2/340 nm: 102 min light and 18 min light and spray)

- **Natural Weathering:** 45° south open rack exposure in Pfeffingen, Switzerland

- **Colour Difference Measurement:** Minolta "CM-3600d" device (gloss included) and calculation of L*, a*, b*, C*, h and DE* with "CGREC" software according to DIN 6174

- **Gloss Measurement:** 60° gloss with Byk/Gardner "Micro-Tri-Gloss" equipment according to DIN 67530

- **Cracking:** Visually according to DIN EN ISO 4628-4

- **UV-VIS Spectroscopy:** Integrated transmission spectra of 20 µm dry film thickness (DFT) on glass 200 nm to 800 nm with 1 nm resolution (Perkin Elmer "Lambda 900" UV/VIS/NIR spectrophotometer)

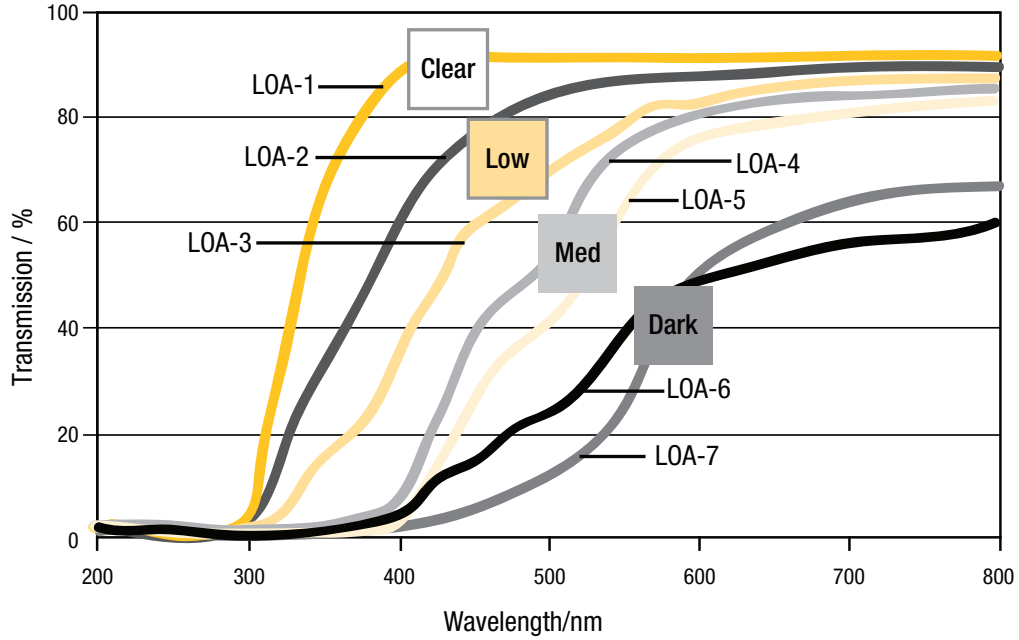

FIGURE 2: Integrated transmission spectra of the LOA paints tested

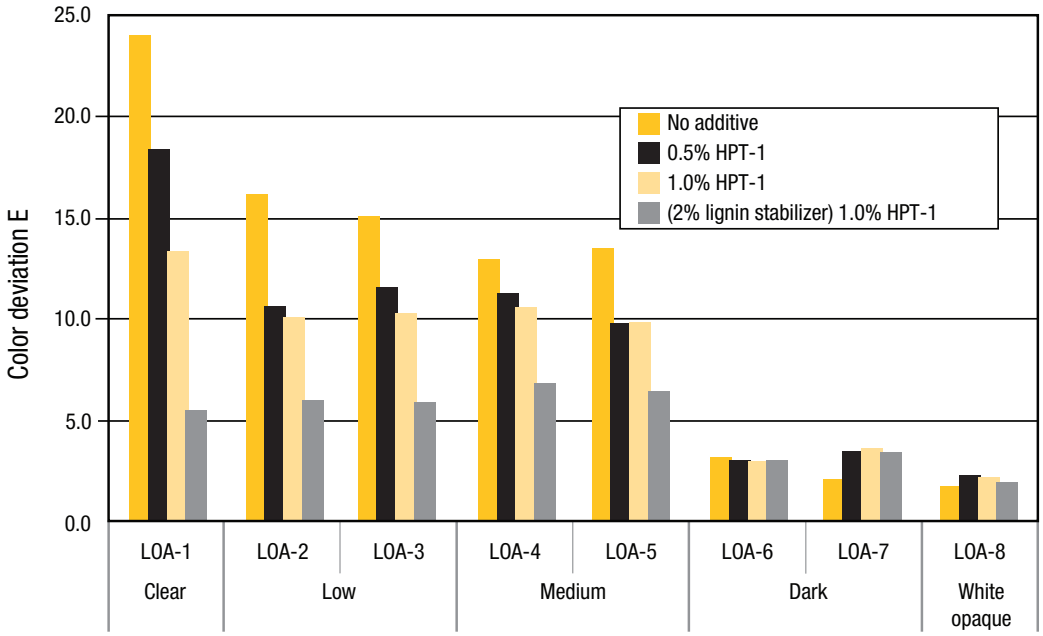

FIGURE 3: Colour deviation of pine with LOA with HPT-1/HALS-2 with and without lignin stabiliser after 1000 h Xe-WOM CAM 7 exposure

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Artificial Weathering

The integrated transmission spectra (i.e., the light protection capacity) of different test coatings are shown in Figure 2. Based on the transmission value at 500 nm they can be classified as:

- clear: > 90% transmission (LOA-1)
- low-pigmented: 90%–60% (LOA-2, -3)
- medium-pigmented: 60%–30% (LOA-4, -5)
- dark-pigmented: 30%–0% (LOA-6, -7) and
- opaque-pigmented: 0% (LOA-8)

Organic light stabilisers—e.g., HPT-1 and HALS-2—and lignin stabiliser pre-treatments were compared. The colour deviation of pine with LOA stabilised with UVA/HALS (0.5% and 1.0% / 0.5% on total paint) with and without lignin stabiliser pre-treatment (2% in aqueous solution) after 1000 h Xe-WOM CAM 7 exposure is shown in Figure 3.

Adapting UVA Use to the Opacity

In the clear-, low- and medium-pigmented finishes, the use of UVA alone reduces the colour deviation on pale wood species to a certain extent, with better results for a higher UVA concentration. The visible light screening of the pigment evidently also improves performance. In all cases, the lignin stabiliser system has the best performance.

The dark LOA-6/7 and white opaque LOA-8 show lowest colour deviation of the non-stabilised paints, and neither the use of UVA nor the use of lignin stabiliser shows any significant benefit in terms of colour retention.

Hence, UVA use can be significantly reduced or eliminated in dark and opaque paints. As an initial recommendation, 1.0% for clears, 0.5% for low to medium opacity, and no UVA for dark or opaque coatings are suggested.

Dark and Opaque Systems Require HALS

However, it is well known that colour retention is not the main problem for dark and opaque pigmented systems. Earlier studies showed that these tend to suffer more from chalking and then complete erosion of the paint and the wooden surface, whereas clear- and low-pigmented systems primarily show cracking. In this case, higher amounts of HALS are necessary to protect the binder against photo-oxidation and avoid surface defects such as gloss loss, chalking, and subsequent flaking [15].

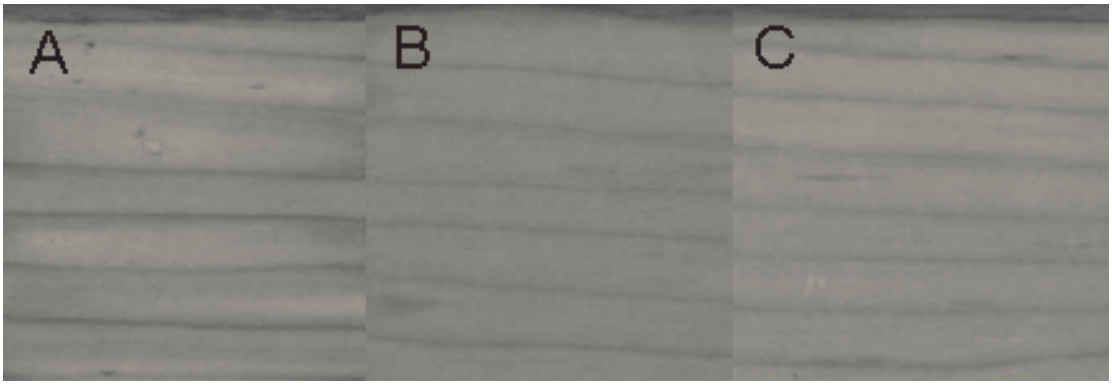

FIGURE 4: Pine with LOA (A: no additive; B: 1% HPT-1 + 0.5% HALS-2; C: 2% lignin stabiliser pre-treatment/1% HPT-1 + 0.5% HALS-2) after 1 year of natural exposure

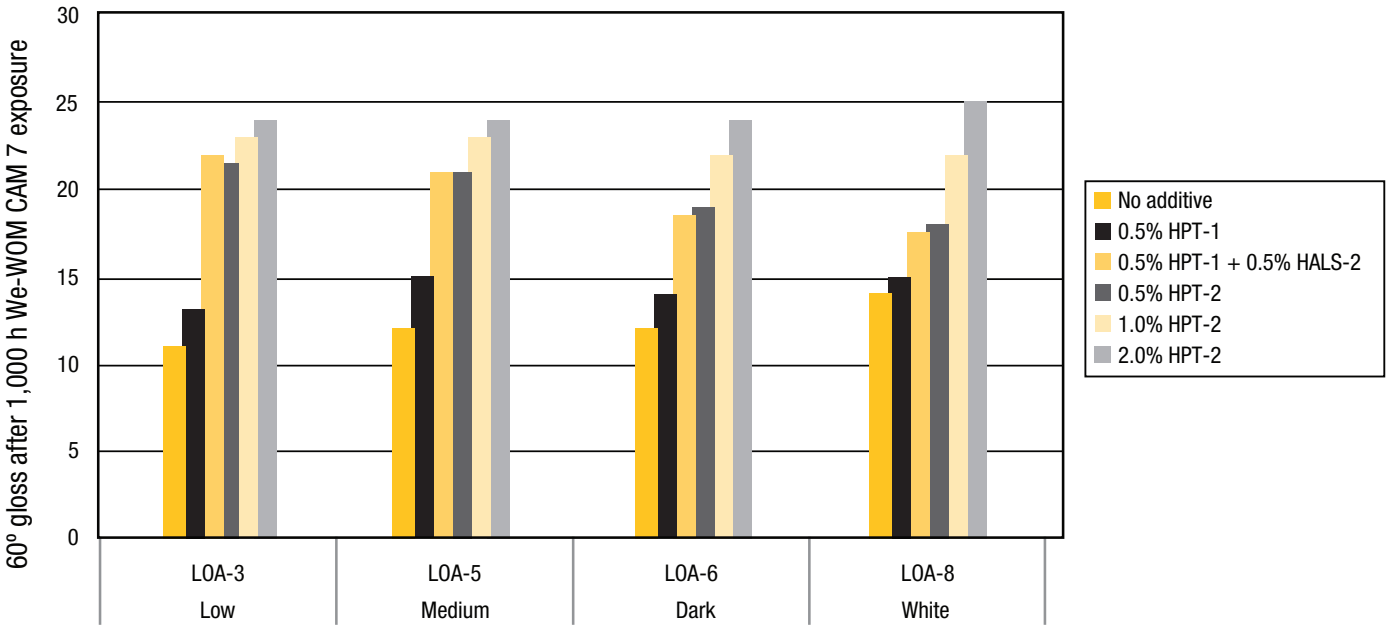

FIGURE 5: Effect of the HALS-2 concentration on 60° gloss of LOA paints after 1 year of natural exposure

Direct Lignin Stabilisation Yields Best Performance

The effect of the lignin stabiliser on colour and coating protection of pine with a clear UVA containing top coat after 1 year of outdoor exposure is shown in Figure 4. Here LOA-1 was applied without (A), with 1% HPT-1 and 0.5% HALS-2 on total paint (B), and the second coating was applied over 2% aqueous solution of the lignin stabiliser (C). System (A) shows gloss loss, cracking, and erosion with greying of the wood surface. The use of HPT-1 and HALS-2 obviously improves the coating properties, but some colour deviation with darkening and yellowing can be seen.

The lignin stabiliser further improves the colour retention to almost retain the initial colour of the wood. In general, this approach shows excellent results in colour retention as well as mechanical properties of the paint film for all common pale wood species like pine, fir, and ash.

Natural Weathering Tests

The effect of HALS on the 60° gloss of LOA paints with different degrees of pigmentation after 12 months 45° south exposure in Pfeffingen, Switzerland, is shown in Figure 5. The initial 60° gloss was around 30 for all paints. After exposure, paints without HALS had a 60° gloss of around 15. The use of UVA shows only slight improvement for all the paints.

HALS Are Always Beneficial

The use of HALS is beneficial, regardless of whether UVA is used. For the low- and medium-pigmented paints (LOA-3, LOA-5), the higher levels of HALS have little advantage over the 0.5% addition.

For the dark LOA-6 and the opaque LOA-8, obvious improvements in performance are only obtained by using 1.0% or even 2.0% HALS. These results indicate that the use of higher amounts of HALS is necessary with increasing pigmentation in the paint.

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There Is No Single Optimal Light Stabiliser Package

These results show the value of light stabilisers in retaining the mechanical and aesthetic properties of outdoor wood coatings. Unfortunately, a single light stabiliser package is not equally suitable for all shades from clear to opaque pigmented systems. But it is possible to give rough guidelines based on the transmission profile of the pigmented paints. In general, the concentration of UVA can be reduced and the concentration of HALS should be increased with increasing pigmentation.

For clear paints, higher amounts of an optimum UVA (0.5% to 1% on total paint) have to be used to protect the substrate, with HALS (0.5%) added to protect the coating from surface defects. In addition, a solution of 1% to 2% lignin stabiliser, preferably used in aqueous solution or an existing primer formulation, helps to retain aesthetic and mechanical properties.

For light- and medium-pigmented systems, the amount of UVA can be reduced to 0.5%, as the pigment itself protects against light, but the amount of HALS should be increased (0.5% to 1.0%). The lignin stabiliser again improves results. In dark- and opaque-pigmented systems, the UVA and lignin stabiliser add no real benefit to the overall performance of the system as long as sufficient amounts of HALS (1% to 2%) are used to avoid surface defects.

This has to be seen as a basic general guideline for starting point formulations. The benefits may differ according to the quality of the binder system, the solids content of the paint, the quantity and type of the pigments used, the final application, and the local weather conditions. Ultimately, it is always the real experiment that tells us the final answer. ■

Results at a Glance

- The degradation of wood surfaces on exposure to light is mainly due to breakdown of the lignin component, which discolours and becomes more hydrophilic.
- Hindered amine light stabilisers (HALS) protect the coating surface by blocking radical reactions initiated by light, while UV absorbers prevent UV light from reaching the substrate.
- A wood pretreatment system that uses a special HALS has been developed to protect lignin from photo degradation due to VIS light. It is shown to have considerable benefits when using low-opacity coatings.
- The most effective means of protecting wood from light damage depends on the opacity of the coating.
- For opaque and dark pigmented coatings, HALS addition must be increased to protect the coating itself from light damage, while for clear-, low- and medium-pigmented systems, high UV absorber levels with lower HALS and lignin stabiliser pre-treatment are more effective.

Acknowledgments

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The Authors

Dr. Christian Schaller studied chemistry at the University of Stuttgart, Germany, and received his PhD in macromolecular chemistry from the Research Institute of Pigments and Coatings, Stuttgart, in 2001. After a post-doc year at the institute involving several industry projects, in 2002 he joined Technical Service, Business Line Coatings, Ciba Inc. In 2003 he took over the responsibility of Application Head for Coating Protection and Wood Coatings. Since 2007 he has been Application Head for Coating Protection, Wood and Architectural Coatings.

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Dr. Daniel Rogez, who has a PhD in Polymer Chemistry from the University of Haute Alsace, France, joined the former Ciba-Geigy company in 1979. Working initially in the paints and inks additives development laboratories, he specialised in antioxidants, light stabilisers and photoinitiators for the European market. He is currently Global Marketing Manager for Additives and Colorants for Decorative and Industrial Paints at Ciba Inc., Basel, dealing primarily with the wood coatings market.

AtlasCommitment to Growth

Weathering Experimenter's Toolbox: The Benefit of Blocking Variables

Blocking variables are a required tool for most weathering experiments. Blocking techniques provide a method for normalizing nuisance factors in experiments.

The term "blocking" comes from agricultural science, in which experiments had to be performed against a background of natural variation—for instance, soils that varied with location. Early ag researchers developed blocks of land where soil conditions were more homogeneous. Other experimental variables could be applied and the results attributed to these test variables rather than the soil variability.

In weathering research today, we must block a plethora of nuisance variables in order to understand the effect of the variables being studied. For example, if a weathering researcher is trying to study the effect of formulation changes on material weatherability, it may be important to block production variables by using a single manufacturing line during a single manufacturing run to produce the test specimens with different formulations. This may block variations due to line and run.

Inventive application of blocking techniques can allow weathering researchers to untangle a large number of root causes of material degradation. These blocking techniques represent the foundation for many weathering experimental designs. ■

MIDDLE EAST COATINGS SHOW 2008

Atlas® to Exhibit in Dubai

If you are planning to attend the Middle East Coatings Show 2008 in Dubai, be sure to look for Atlas. We will be exhibiting for the second time at the region's largest coatings show, set for **March 10–12** at the Dubai International Convention and Exhibit Centre.

We will showcase Atlas' latest product enhancements and state of the art weathering technology, including the Ci4000 Weather-Ometer®, which offers an enhanced digital control system that gives operators more flexibility and control of their accelerated weathering testing.

We will also present our SUNTEST® XLS+. With 980 cm² exposure area, the SUNTEST XLS+ is an economic alternative testing device for companies with small specimens common in the coating industry.

Visit Atlas at **Hall 6/7, Booth J21,** to see how we can help you meet your coating industry testing needs!

ATCAE 2008: Atlas Brings Automotive Experts to Oxford

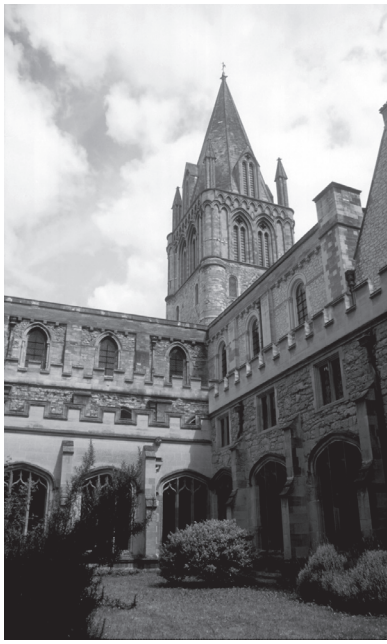
The third Atlas **Technical Conference for Accelerated Ageing and Evaluation** (ATCAE) will take place on **September 15–16, 2008,** in Oxford, England. The two-day conference will focus on the automotive industry. Participants will hear from and interact with speakers from the automotive industry, including suppliers and Atlas weathering experts, to learn more about weathering testing as it relates to this important industry.

Speakers will present on weathering tests for interior and exterior materials, as well as correlation and results of Round Robin tests. Automotive suppliers will focus on testing procedures for new materials as well as on the latest testing procedures for interior or exterior materials in order to meet the requirements of the OEMs.

Atlas speakers will present new technologies for accelerated aging tests on materials and components, as well as measurement techniques of relevant parameters, including important aspects for outdoor testing procedures.

Besides gaining insights into the newest results and the latest weathering technologies, participants will have the chance to visit the BMW manufacturing plant in Oxford.

Details about topics, speakers, and registration will be available in the spring. For more information, please contact Mr. Bruno Bentjerodt, Atlas Client Education, at **bbentjerodt@atlasmtt.de,** or visit our website at www.atlas-mts.com. ■



Christ Church College in Oxford, UK, location of the third Atlas Technical Conference for Accelerated Aging and Evaluation.

Exacolor Chosen to Represent Atlas in Northern Mexico

Atlas is excited to announce the appointment of EXACOLOR S.A. de C.V. as its new agent for sales and service of its products in northern Mexico, including Monterrey, San Luis Potosí, and the Zona Frontera.

Exacolor (www.exacolor.com.mx), headquartered in Monterrey, Nuevo León, has been a leader in physical testing, color, and appearance instrumentation for more than 17 years. It is the exclusive representative for sales and service for BYK-Gardner Instruments, a world leader in the coatings and plastics industries. Exacolor also represents VMA-Getzmann GMBH, GTI, HERO Products, and NCS, among others.

Atlas has long known Exacolor for its industry-leading technical service, calibration, and after-sales support for its customers throughout Mexico. It was the first laboratory in Mexico to receive ISO 17025 accreditation and has been chosen as the reference laboratory for the paint industry by ANAFAPYT (National Association of Paint and Ink Producers).

To ensure optimal support for our customers in northern Mexico, Atlas will continue to train and support the engineers of Exacolor on our xenon, UV/fluorescent, and corrosion instruments.

AtlasTest Instruments Group

New Sensors Added to XenoCal® Sensor Series

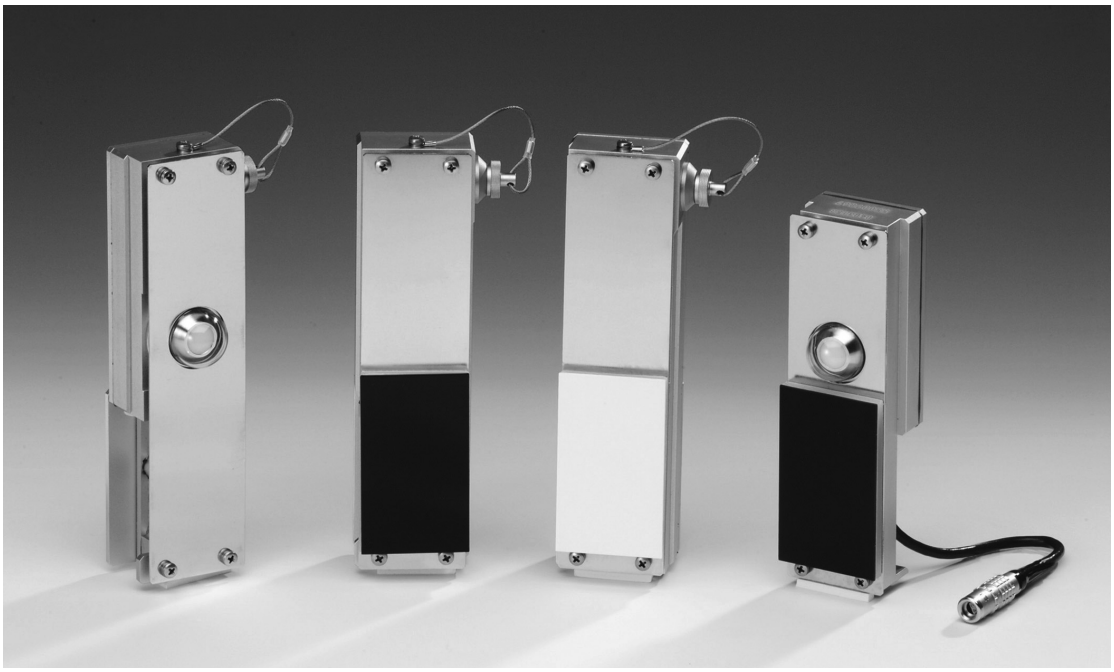
Atlas is excited to launch two new XenoCal sensors for measurement and calibration. XenoCal sensors provide both independent irradiance calibration and measurement as well as independent temperature calibration and measurement at the sample level.

The latest sensor, XenoCal BB 300-400 BST, for the first time combines both weathering parameters—irradiance control between 300 and 400 nm and Black Standard Temperature at sample level. The new "multi-sensor" provides high accuracy measurements, as both values are measured at the same time and place. The simultaneous collection of the measured values also provides advantages in time and money.

The second new Sensor, XenoCal Lux, has been specially introduced for the Atlas SUNTEST® CPS/CPS+ und XLS/XLS+. These instruments are well established in the pharmaceutical industry, where tests according to the ICH Guideline Q1B are common. The new XenoCal LUX sensor provides for instrument calibration in Lux. For example, the precise compliance and documentation of required test times in Lux hours is now possible.

XenoCal sensors have the advantage of being device-independent. They are used directly at sample level during an accelerated weathering test and are easy to handle with the help of free PC software. The Atlas calibration laboratory is certified to DIN ISO 17025, to guarantee the accuracy of the sensors.

Both sensors will be available this spring. More information can be found on the home page at www.atlas-mts.com. Requests may be sent to **info@atlasmtt.de.** ■



Atlas Introduces Advanced Digital Control System for Ci5000 Weather-Ometer®

Two new models with improved functionality, scalability and ease-of-use to meet exacting test parameters

Atlas is pleased to introduce two new Ci5000 Xenon-arc Weather-Ometers with enhanced digital control to give operators more flexibility and control of their accelerated weathering testing. Now available in a standard irradiance or an extended irradiance model, the Ci5000 is perfect weathering instrument for large capacity, accelerated laboratory weathering.

One of the most notable changes for both units is a modern, full-color TFT touch screen display with intuitive icons for easier interpretation of operating parameters and warnings. However, at the heart of the upgrade is the embedded control system that replaces the PLC controller of the previous generation. Internally, analog control circuits have been replaced with a robust digital network for more reliable and accurate control and monitoring of the data. Memory capacity has been significantly increased, allowing for additional features and functions previously managed by external controllers—such as water resistively and lamp water temperature. Now with a single control system, operators can more efficiently analyze instrument performance, monitor test parameters, and perform calibration procedures.

Among other features and benefits of the new control system are:

- Sub-cycle repeat programming for copying standards and saving them as templates
- Full-color trend plot screen with large memory
- Smart media card interface for test data portability
- Smart sensors that communicate their status to the touch panel at power-up
- Streaming data output formatted for compatibility with modern laboratory information management systems (LIMS).

The advanced digital control system is built with scalability for future upgrades. New software versions will simply be uploaded via the interface.

The standard irradiance model will use the same high-quality 12 kW water-cooled lamp, but the unit has been redesigned to use the same incoming line voltage as the discontinued Ci65A series Weather-Ometer. As control systems and repair parts for these older instruments are becoming obsolete or hard to source, Atlas has made it easier than ever to replace those units. For customers running standard ASTM, SAE, or AATCC test cycles, there will be no need to upgrade the incoming power to your lab. The Ci5000 standard irradiance model will be capable of running at the same irradiance levels as the Ci65A. If it becomes necessary to run test methods with higher irradiance levels (0.70 W/m² @ 340 nm or higher), the instrument can be retrofitted in the field to accommodate these tests.*

For more information about the new Ci5000 advanced control system, please contact a sales representative at 1-773-327-4520 or **info@atlas-mts.com.** Visit the Atlas website at www.atlas-mts.com. ■

** Customer must supply appropriate incoming line voltage/current to accommodate the increased wattage necessary to run high irradiance tests. Call Atlas for specifications and details.*

AtlasTest Instruments Group

Atlas Announces Breakthrough Filter Technology

Atlas is proud to announce a new filter that will revolutionize xenon-arc filter technology… the **Atlas Right Light™ filter.**

Of the three recognized factors of weathering (light, temperature, and moisture), it is widely accepted that the most important of these is light. When we speak of comparing natural weathering degradation mechanisms with those of accelerated weathering cabinets, it is the quality of light that is critical.

Most weathering experimenters have seen the following graphics in some context to illustrate the importance of the quality of light. Figure 1 shows that shorter wavelengths have higher photon energy, making this area of the spectrum most crucial to match. Figure 2 shows a standard spectral power distribution (SPD) graph of natural sunlight.

Xenon-arc has long been recognized as the closest available full spectrum match to natural sunlight. The ultimate goal of weathering instrument manufacturers like Atlas has been to match the natural sunlight SPD curve, especially in the short wavelength UV.

A Type S Borosilicate inner and outer filter combination has historically been adopted as a combination comparable to direct sunlight. The SPD of this combination is relatively close, and meets performance-based standards definitions of "daylight" filters, such as ASTM G155 and SAE J2527. [1] Some improvements have been made more recently with the advent of the CIRA (coated infrared absorbing) filter in combination with a Soda Lime outer filter. Both of these combinations were good and represented the "best available." But there were still minor deficiencies, as noted in studies by Gerlock, et al. [2].

FIGURE 1

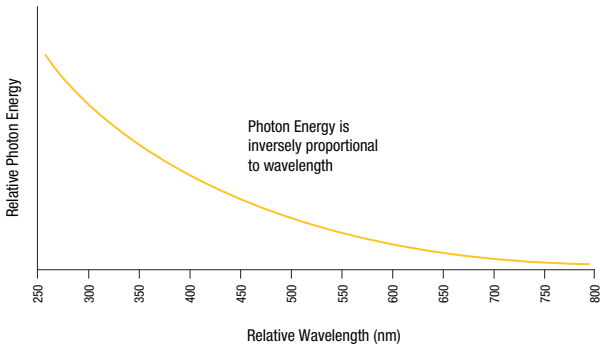
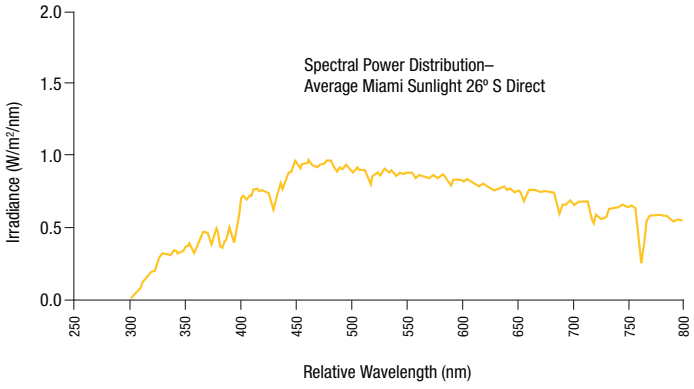


FIGURE 2



This is where Atlas' revolutionary new product comes in. When used in combination with a quartz outer filter or a newly developed CIRA outer filter (for cooler black panel temperatures), the Right Light filter has an unparalleled match to natural sunlight, especially in the most critical short wavelength UV region.

Figure 3 shows the comparison of the Right Light filter (used in combination with a quartz outer filter) as compared to natural sunlight. Figure 4 shows how closely Right Light (and a Borosilicate inner and outer filter combination) compares to natural sunlight on a logarithmic scale.

Applications work with this new filter combination has shown that material degradation can more closely match that of end-use service environments. Additionally, since the cut-on to the short wavelength UV matches so well, experimenters can increase irradiance levels for better acceleration without

FIGURE 3: Right Light Filter System vs Sunlight

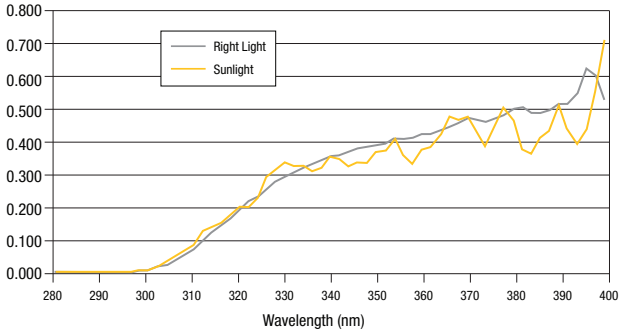
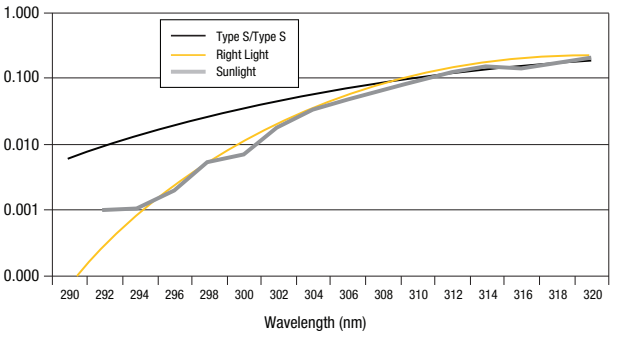


FIGURE 4: Light Filter System vs Sunlight



compromising correlation. Finally, the chemistry of the filter is such that its recommended life is the same as that of an Atlas xenon lamp, approximately 2000 hours.

"Atlas' R&D group has been working with our lamp filter suppliers to make this product commercially available for several years, and this year we will accomplish that goal," explained Matt McGreer, Global Manager of Weathering Instruments for Atlas. "This technology is the future of xenon-arc weathering."

Mark Nichols of Ford Motor Company has said that "the precise simulation of terrestrial sunlight, particularly in the short UV range, is even more critical for reliable weatherabilty testing of automotive coatings than originally thought. Xenon light used in conjunction with the Right Light filter provides the appropriate ultraviolet spectrum for weathering of today's complex automotive coatings."

For more information on Right Light filters, contact your local Atlas sales representative or e-mail **info@atlas-mts.com.** ■

References

[1] ASTM G155-05 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials, ASTM International, West Conshohocken, PA, 2005. SAE J2527 – Performance Based Standard for Accelerated Exposure of Automotive Exterior Materials Using a Controlled Irradiance Xenon-Arc Apparatus, Warrendale, PA, 2004.

[2] "Paint Weathering Research at Ford," J.L Gerlock, A.V. Kucherow, and C.A. Smith, 2001, *Sun Spots*

AtlasClient Education

Atlas Client Education helps clients learn to design durability test programs to understand how weathering affects materials. Our education and training solutions will help you and your staff effectively master the skills and knowledge needed to develop long-lived products in shortened development cycles. Our programs are designed for all levels to ensure that everyone develops the skills required to understand the fundamentals of weathering and how to operate our instruments. For the latest schedules and locations, check the Atlas website, **www.atlas-mts.com,** or e-mail **info@atlas-mts.com.**

2008

Fundamentals of Weathering I

April 8
Lochem, The Netherlands

April 10
Paris, France

June 3
Leipzig, Germany

June 18
Chicago, Illinois, USA

October 1
Chicago, Illinois, USA

October 7
Oensingen, Switzerland

November 4
Kassel, Germany

Fundamentals of Weathering II

April 9
Lochem, The Netherlands

April 11
Paris, France

June 19
Chicago, Illinois, USA

October 2
Chicago, Illinois, USA

October 8
Oensingen, Switzerland

November 5
Kassel, Germany

Weather-Ometer® Workshop

June 17
Chicago, Illinois, USA

November 25–26
Linsengericht, Germany

Ci4000/Ci5000 Workshop

September 30
Chicago, Illinois, USA

Webinars

March 20
Weathering Design of Experiments (Weathering DOEs)

March 27
Photodegradation and Stabilization Mechanisms of Polymers

Xenotest® Workshop

October 21–22
Linsengericht, Germany

SUNTEST® Workshop

October 24
Linsengericht, Germany

ATLAS WEBINARS

Atlas is pleased to announce that client education programs are now available online. These webinars are designed to help weathering professionals and product manufacturers continue their weathering education and learn more about the factors of weathering testing.

A range of topics will be discussed to help individuals learn how to perform weathering tests, know the impact of each factor of weathering, analyze results, and modify procedures or design test methods for their specific needs.

2008 Webinar Topics include:

- **Pharmaceutical Photostability Testing: Small and Large Molecules According to ICH Guidelines**
- **The Factors of Weather and Weathering Testing of Polymers**
- **Successful Weathering Testing**
- **Weathering Design of Experiments (Weathering DOEs)**
- **Photodegradation and Stabilization Mechanisms of Polymers**

To register please visit www.atlas-mts.com.

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 info@atlas-mts.com.

Or visit our website at **www.atlas-mts.com.**

Carbon Arc Testing Laboratory Gets Reaccredited

Atlas is pleased to announce that our laboratory in Bicester, UK, specializing in carbon arc testing, gained accreditation according to DIN ISO 17025:2005.

The recertification, given by the German Accreditation Council, confirms the high standard at which Atlas Weathering Services Group performs. The laboratory in Bicester offers Atlas' Ci Series and Xenotest® xenon arc weathering instruments as well as SUNTEST® table-top units. The laboratory also houses a number of enclosed/sunshine carbon arc instruments making it the most comprehensive carbon arc testing facility in Europe.

The gradual shift away from carbon arc test devices has caused problems for many suppliers, especially in Asia. Standards like ISO 4892-4, JIS B 7753, and some producer-specific standards still require carbon arc testing for interior and exterior materials like bumpers, airbags, and paints. Atlas Lab UK remains poised to handle these tests. Inquiries may be sent to labordu@atlasmtt.de or directly to the laboratory in Bicester: tracy.tomkins@atlasmtt.co.uk.

For more information about carbon arc testing or the reaccreditation, please write **labordu@atlasmtt.de.** ■

European Test Laboratories Reaccredited

Now Have Flexible Scope

The Atlas test laboratories in **Duisburg (Germany), Moussy-Le-Neuf (France),** and **Bicester (UK)** were recently reaccredited by Deutscher Akkredititerungsrat (DAR), an internationally renowned accreditation council affiliated with the Federal Institute for Materials Research and Testing of Germany.

Featuring a variety of xenon, carbon-arc, fluorescent and metal halide weathering instruments, the European labs can now meet accelerated test methods from corporate, national and international standards organizations with a flexible scope. This means that all three labs can perform all accelerated weathering and lightfastness tests according **DIN EN ISO/IEC 17025:2005;** the accreditation is no longer limited to listed standards.

The European labs are part of Atlas Weathering Services Group (AWSG), one of the largest networks of ISO/IEC 17025:2005-accredited accelerated weathering testing laboratories in the world. With laboratories in the United States, France, Germany and the UK, AWSG offers artificial accelerated weathering tests and a variety of other environmental test programs, all designed to accurately simulate true end-use conditions and meet global weathering standards. ■

Atlas Weathering Services Group

Weather by Numbers: AWSG Temperature Reporting

The weathering of material cannot be studied without considering the three factors of weathering: **radiation, moisture** and **temperature.** Every Atlas Weathering Services Group (AWSG) client has access to radiation, ambient relative humidity, and temperature readings free of charge via our online Live Test Tracking—one of our many value added services.

AWSG also offers additional data reporting services that can provide you with an even more precise data image of the weathering of your material. AWSG has the capabilities to mount many types of sensors, including thermocouples (i.e., T and K), relative humidity sensors, and strain gages (expansion and contraction of material) as well as client supplied devices. Sensors can be mounted in and around any type of three-dimensional object for a complete picture of weathering by numbers.

Data reports can be formatted from the basic (raw data) to special reporting (complementing atmospheric data with descriptive graphs and tables). Data can be quickly pasted into your own statistical analytical software for immediate analysis. Advanced temperature reporting is a valuable tool in service life predictions.

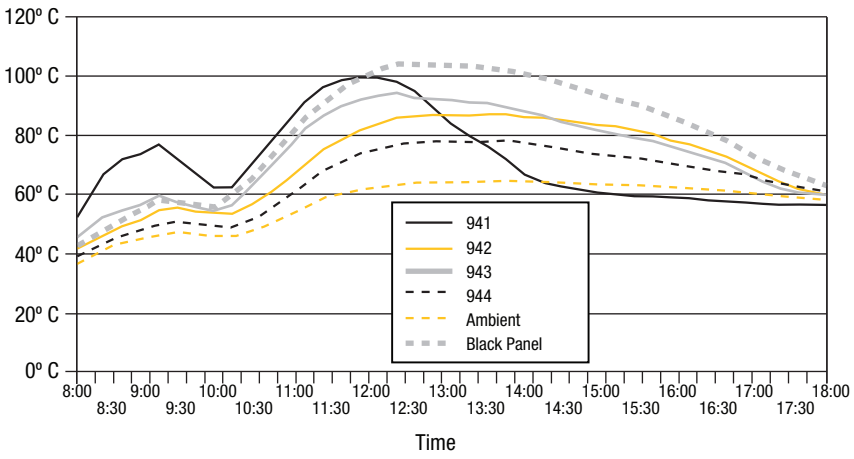
For information about temperature reporting for a new or existing test, please call an AWSG customer service representative at **1-800-255-3738.** ■

Sample Data Report

New River, Arizona • Temperatures in °C • Sample: 11094

Date	Time	Door panel driver's side front	A-pillar driver's side	Sun visor driver's side	Roof center	Dashboard center
24-Dec-07	8:00	56.17º	43.08º	46.53º	40.85º	50.12º
24-Dec-07	8:15	66.90º	46.35º	51.72º	43.98º	56.63º
24-Dec-07	8:30	72.00º	49.22º	54.53º	46.51º	60.51º
24-Dec-07	8:45	73.70º	51.51º	56.32º	48.07º	62.88º
24-Dec-07	9:00	76.70º	54.66º	59.66º	50.09º	66.90º
24-Dec-07	9:15	72.00º	55.47º	57.53º	50.71º	64.97º
24-Dec-07	9:30	67.40º	54.28º	55.76º	49.66º	63.49º
24-Dec-07	9:45	62.38º	53.75º	54.34º	49.18º	62.03º
24-Dec-07	10:00	62.31º	53.48º	56.33º	48.76º	64.90º
24-Dec-07	10:15	70.00º	56.38º	62.64º	51.02º	73.00º
24-Dec-07	10:30	77.00º	59.99º	68.46º	54.41º	80.10º
24-Dec-07	10:45	83.70º	64.60º	75.10º	58.92º	88.30º
24-Dec-07	11:00	91.10º	70.10º	82.30º	63.77º	97.10º

Sample Graph



Vehicle temperature and solar radiation measurements.

Are you applying all five critical components?

Implementing a scientifically designed weathering program puts you in a better position to predict product performance in real-world conditions. It begins with design of experiment and incorporates material screening, accelerated laboratory testing, outdoor weathering testing and independent laboratory validation. Whether you're testing the damaging effects of sunlight on patio furniture or polymer degradation of coatings, our experts help you achieve accurate, repeatable and reproducible test results so you can rest assured your product is capable of beating the elements.

Give Atlas a call today at 1-877-327-4520 (toll-free for U.S. only) or visit www.atlas-mts.com.

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