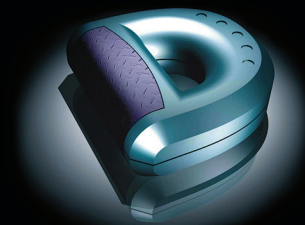


SOMOS® WATERSHED BLACK

A multi-purpose, environmentally durable SLA material suitable for weather-able applications that eliminates the need for painting.



Drumlord Limited
Prototyping Technologies

PRODUCT DESCRIPTION

Built on the proven technology of one of the industry's most popular resins, Somos WaterShed Black is an environmentally durable SLA material suited to weatherable applications. Exposed under robust SAE J2527 industry standard weathering testing, Somos WaterShed Black meets the demands of weatherability, UV-testing and durability for functional prototyping and end use parts production.

Compared to alternatives currently on the market, Somos WaterShed Black prints a truer black colour off the machine and offers a smooth surface finish as well as higher moisture and chemical resistance. With similar properties to WaterShed XC11122, WaterShed Black proves to be a versatile all-rounder that is well suited to a wide variety of applications.

KEY BENEFITS

- Best-in-class environmental durability performance - measured using SAE J2527 industry standard testing methods rather than just UV light
- A truer black colour off the machine
- Built on the proven technology of Somos WaterShed XC 11122
- Smooth surface finish
- Higher moisture and chemical resistance

IDEAL APPLICATIONS

- Durable, stiff, tough parts
- Automotive components
- Electronic housings
- Packaging
- Functional prototypes and end use parts

SOMOS® WATERSHED BLACK

LIQUID PROPERTIES		OPTICAL PROPERTIES		
Appearance	Black	E _c	8.4 mJ/cm ²	[critical exposure]
Viscosity	~260 cps @ 30°C	D _p	4.15 mils	[slope of cure-depth vs. ln (E) curve]
Density	~1.127 g/cm ³ @ 25°C	E ₁₀	93.4 mJ/cm ²	[exposure that gives 0.254 mm (.010 inch) thickness]

MECHANICAL PROPERTIES		UV POSTCURE	
ASTM METHOD	PROPERTY DESCRIPTION	METRIC	IMPERIAL
D638M	Tensile Strength at Break	50.4 MPa	7.3 ksi
D638M	Elongation at Break	15.5%	15.5%
D638M	Elongation at Yield	3%	3%
D638M	Tensile Modulus	2,770 MPa	402 ksi
D790M	Flexural Strength	68.7 MPa	10.0 ksi
D2240	Flexural Modulus	2,205 MPa	320 ksi
D256A	Izod Impact (Notched)	25 J/m	0.47 ft-lb/in
D570-98	Water Absorption	0.35%	0.35%

THERMAL/ELECTRICAL
PROPERTIES OVERLEAF >>

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THERMAL/ELECTRICAL PROPERTIES		UV POSTCURE	
ASTM METHOD	PROPERTY DESCRIPTION	METRIC	IMPERIAL
E831-05	C.T.E. -40 - 0°C (-40 - 32°F)	67 $\mu\text{m}/\text{m}^\circ\text{C}$	37 $\mu\text{in}/\text{in}^\circ\text{F}$
E831-05	C.T.E. 0 - 50°C (32 - 122°F)	93 $\mu\text{m}/\text{m}^\circ\text{C}$	52 $\mu\text{in}/\text{in}^\circ\text{F}$
E831-05	C.T.E. 50 - 100°C (122 - 212°F)	180 $\mu\text{m}/\text{m}^\circ\text{C}$	100 $\mu\text{in}/\text{in}^\circ\text{F}$
E831-05	C.T.E. 100 - 150°C (212 - 302°F)	187 $\mu\text{m}/\text{m}^\circ\text{C}$	104 $\mu\text{in}/\text{in}^\circ\text{F}$
D150-98	Dielectric Constant 60 Hz	4.0	4.0
D150-98	Dielectric Constant 1 KHz	3.8	3.8
D150-98	Dielectric Constant 1 MHz	3.5	3.5
D149-97a	Dielectric Strength	15.9 kV/mm	404 V/mil
E1545-00	T _g	43°C	109°F
D648	HDT @ 0.46 MPa (66 psi)	50°C	122°F
D648	HDT @ 1.81 MPa (264 psi)	49°C	120°C

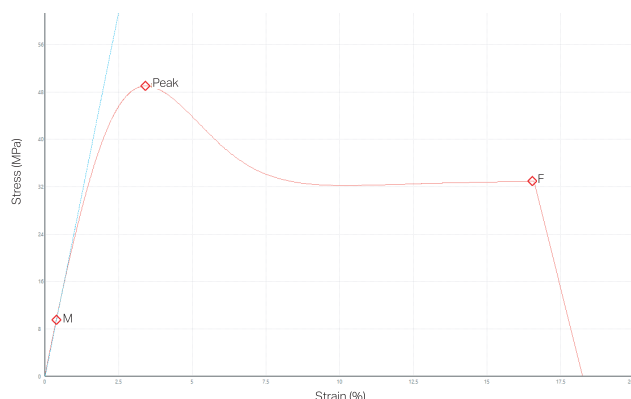
These values may vary and depend on individual machine processing and post-curing practices.

STRESS STRAIN CURVE

This stress strain curve visualizes the behavior of the material as force is applied.

Somos WaterShed Black exhibits plastic behavior, with a yield point, followed by plastic deformation.

Figure 1: Stress Strain Curve



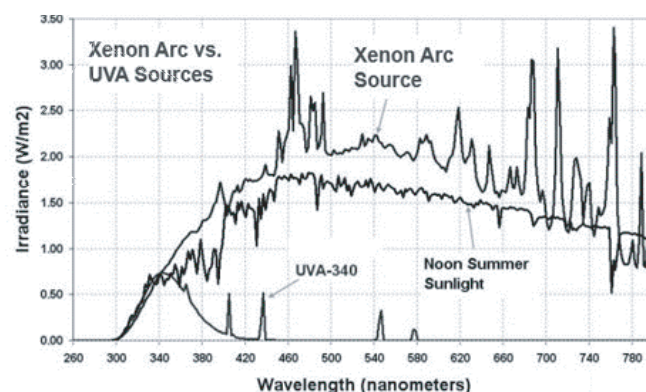
ENVIRONMENTAL DURABILITY

There are many accelerated tests available to determine the aging performance of materials. Since these are accelerated tests, understanding the key exposure factors in the application is critical to choosing the appropriate test. This is because materials respond differently to the conditions of

irradiation, heat and moisture. It is also critical when sharing data, to explicate test conditions so that users can determine how to factor performance to their requirements. Finally, showing correlations to actual weathering is only valid if one has weathered their materials in those real conditions. Below results illustrate the case for exterior exposure.

A standard test developed for the automotive industry for exterior exposure is SAE J2527. This standard utilizes a light source that replicates sunshine across the spectrum. Figure 1 compares a Xenon source to the commonly used UVA lamp source.

Figure 2: Xenon Arc Irradiation (Source: Q-Lab)



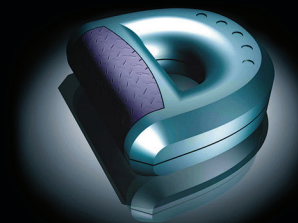
WEATHERING PERFORMANCE
PROPERTIES OVERLEAF >>

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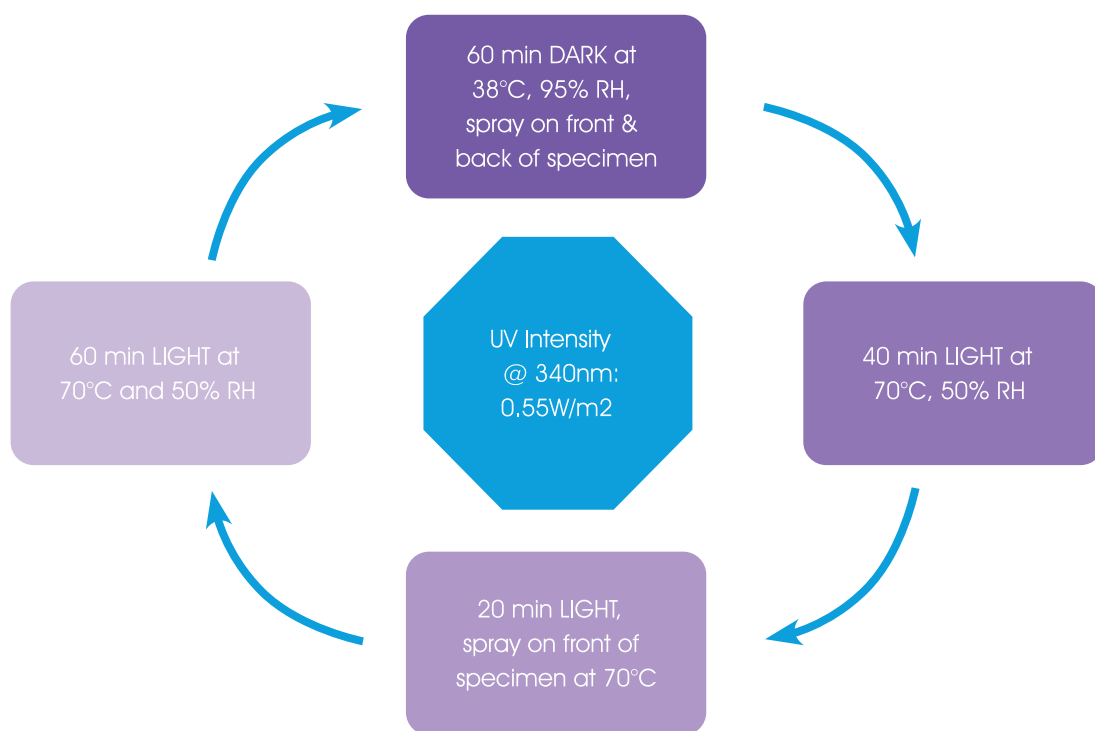
Xenon arc lamps represent very well solar radiation spectral distribution. Total Irradiance is much higher with a Xenon source:

IRRADIATION INTENSITY	340MM	295-400MM	300-800MM
Xenon Light (J2527)	0.55 W/m ²	60 W/m ²	550 W/m ²
Fluorescent (UVA-340)	0.55 W/m ²	32 W/m ²	-

The SAE J 2527 Test is conducted using conditions and cycle as shown in Figure 3:

SAE J2527 IS ONE ACCEPTED STANDARD FOR EXTERIOR WEATHERING TESTING

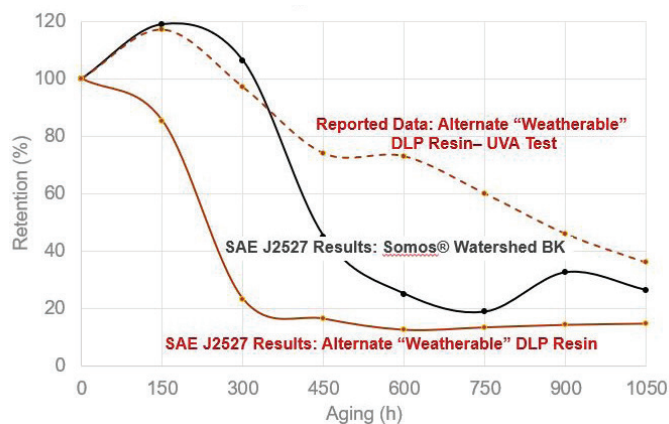
Figure 3: SAE J2527 Test Cycle



WEATHERING PERFORMANCE

Figure 4 shows the weathering performance of Somos WaterShed Black and compares it to an alternative photopolymer commercialized for weatherable applications. The alternative shows good property retention when exposed to UV light with the commonly used UVA lamp. When exposing the resin to a Xenon Arc lamp - a test method that mimics more closely actual sun light - the performance goes down faster and stabilizes on a much lower level. To avoid major discrepancy between anticipated material behavior and actual material behavior of parts in the field, matching accelerated test with real live conditions is critical.

Figure 4: Xenon Arc Irradiation (Source: Q-Lab)



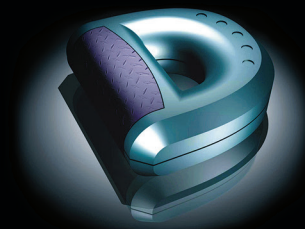
CHEMICAL COMPATIBILITY
PROPERTIES OVERLEAF >>

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CHEMICAL COMPATIBILITY

Somos WaterShed Black shows good resistance to many common chemicals.¹

Figure 5: Chemical resistance

SUBSTANCE	RESISTANCE
Water	Excellent
Saline (0.9%)	Excellent
Gasoline	Excellent
Diesel Fuel	Excellent
Engine Oil	Excellent
Windshield Wash	Good
Ethylene Glycol	Excellent
Brake Fluid	Excellent
Transmission Fluid	Excellent
Acetone	Good
Isopropanol	Excellent
Ethanol	Good
Methanol	Fair
Bleach	Good

Chemical compatibility tests performed on the transparent version, Somos WaterShed XC11122.

RETENTION OF MECHANICAL PROPERTIES AFTER EXPOSURE

This graph shows the retention of tensile modulus after 7-day immersion in the listed substance. Somos WaterShed Black maintains properties well when subjected to these materials. If you require data from other chemicals, please reach out to our us.

This graph shows the retention of tensile elongation after 7-day immersion in the listed substance. Somos WaterShed Black maintains elongation and ductility well when subjected to these materials. If you require data from other chemicals, please reach out to us.

Figure 6: Tensile Modulus Retention of Somos WaterShed Black after 7-Day Immersion

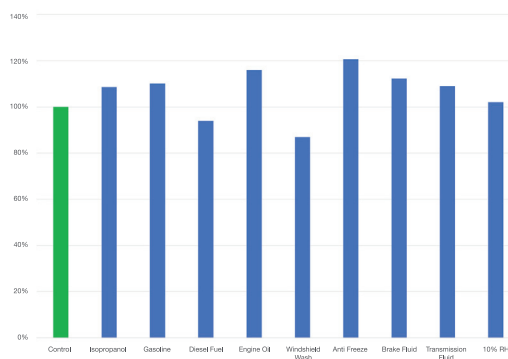
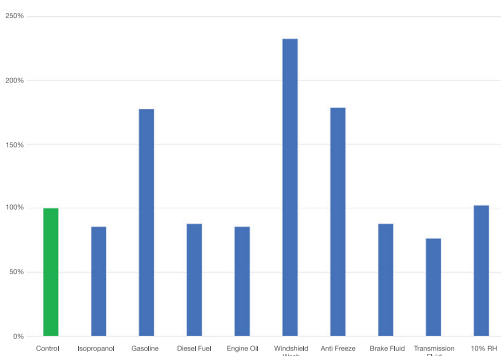


Figure 7: Elongation at Break Retention of Somos WaterShed Black after 7-Day Immersion



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