



Technical Specifications for UltraTek Protective Coatings

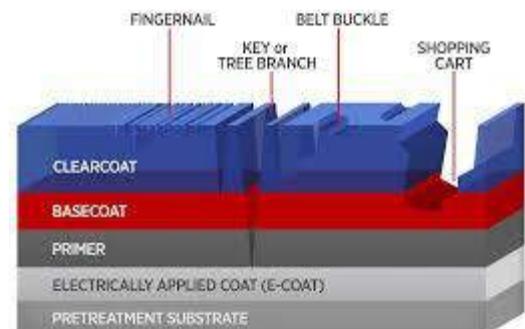
UltraTek' coatings provide critical asset protection for all vehicle types. Working with international suppliers and innovative technical teams, UltraTek use advanced coating materials that have also been applied to architectural, medical and industrial electronics. The need to understand their performance qualities is essential. Let's learn more about the technology and testing behind the products.

HARDNESS

What is hardness? In the coating industry hardness is the capacity of a given coating to resist damage by wear, scratching or marring.

Why is hardness important? Mechanical damage - In many automotive paint coating systems, the uppermost layer is a clear coating (ranging between 5–50 μm in thickness), which not only protects the underlying layers from chemical and UV degradation, but also provides protection from mechanical damage that can result in scratches. To improve fuel economy and reduce the environmental damage caused by harmful solvents, automotive original equipment manufacturers (OEMs) are increasingly using lighter and softer materials for vehicle components, including paint. Regardless of the underlying surface, scratches may be various sizes, from very small, micron size scratches, to very large, millimetres in width.

Deep and wide scratches are caused by objects moving across a surface with a larger force, such as fingernails, tree branches, keys, belt buckles and shopping carts. These scratches typically lead to fracture of at least part of the clearcoat and may in extreme cases extend all the way to the underlying material. Any radial cracks or other damage fracturing the clearcoat



will scatter light and make the scratch appear white, causing the scratch to be easily visible to the naked eye. Scratch widths on vehicles can range from very small (under 25 µm) to very large (over 1 mm).

Film flexibility - UltraTek understands that a coating that is extremely hard may not be flexible (ie. it may be brittle) and therefore may tend to long term cracking with movement experienced from normal vehicle use. UltraTek coatings have been engineered to find the right balance between hardness and flexibility.

Gloss - Hard coatings with high gloss also assist with improved dirt and stain resistance.

How is hardness tested? There are several tests which can measure hardness. For automotive paint, the Pencil Hardness test is the most accurate. The test for pencil hardness is rather simple to do, however results may vary depending on the equipment and procedure used for the test.

A series of graded pencils are inserted into a testing apparatus and moved across a sample. When expressing the measurement of pencil hardness, we do so with a value scale that ranges from 6B, softest, to 9H, hardest. Most automotive paints have a standard hardness of between 2H and 4H.



A coated panel is placed on a firm, horizontal surface. The pencil is held firmly against the film at a 45° angle (point away from the operator) and pushed away from the operator. The process is started with the softest pencil and continued up the scale of hardness. The hardness of the first pencil that will scratch the film is recorded. Pencil Hardness tests are conducted in accordance with American Standard Test Method D3363.



Hardness of UltraTek products Ceramic Paint Protection is a premium ceramic type paint protection system. Designed as a specific blend of polysilazane and polysiloxane polymers, Ceramic Paint Protection polymers cure by reacting with water from the atmosphere to form a super hard matrix. The polymers also react with

the existing paint surface to ensure that Ceramic Paint Protection chemically bonds to the vehicle. Ceramic Paint Protection has been designed to achieve 5H pencil hardness when fully cured. This hardness means that the coating is tough enough to resist scratching and provide superior dirt resistance, whilst ensuring flexibility needed for everyday motoring.

UltraTek fabric, leather and vinyl care products are not designed to be hard, they are designed to be flexible. These coating are being applied to “soft” materials and need the extra plasticity to ensure that they do not crack and flake off the surfaces.

MAR RESISTANCE

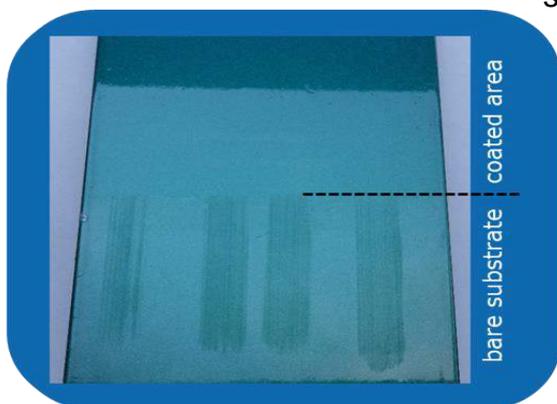
What are mars? At the smaller end of the scratch spectrum are micro-scratches, which are often referred to as mars. These mars are typically only a few microns in width and depth, and do not fracture the clearcoat. A minimal amount of material is removed from the surface during the mar event. When mars occur in large numbers, they can reduce the overall gloss of the clearcoat. It is usually difficult to detect a single mar in a clearcoat finish with the naked eye, due to its nature and size. However, as the paint system is exposed to continued damage, their numbers increase, along with their visibility. Once a significant number of mars are present, they can be easily seen on sunny days.



How is mar resistance tested? The Crock Meter Test is an internationally recognized test designed to simulate the rubbing action generated by a human finger and forearm. The test uses standard pressure and rubbing motion to provide quick and accurate test results. Primarily used to evaluate the amount of



colour transferred from textile materials to other surfaces by rubbing, the Crock Meter is also used to perform scuff and mar tests on flat painted surfaces. Test

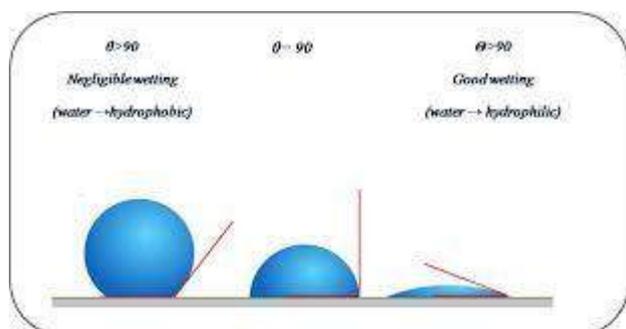


samples are clamped in place with the sample holder. A hand crank moves a reciprocating arm back and forth in a straight line with each complete turn of the crank. The arm is weighted to provide a constant load on the sample. A standardized crocking cloth is used as the abradant. Tests are performed by rubbing the sample a certain number of times over a prescribed period. The change of appearance of the sample is recorded.

Mar resistance of UltraTek products As the diagram above shows, UltraTek Ceramic Paint Protection is designed to resist marring and micro scratches. Micro scratches occur relatively easily compared with areas coated with Ceramic Paint Protection. UltraTek leather and vinyl care products are designed to resist marring and scuffing. Slight scuffs will even self-heal with the smart technology used in UltraTek coatings.

HYDROPHOBIC PROPERTIES

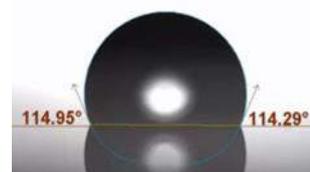
What is hydrophobic? Coatings are generally hydrophobic – water hating, or hydrophilic – water loving. A hydrophobic coating is a surface layer that repels water making the surface "waterproof". Droplets hitting this kind of coating can either fully rebound or only have a tiny part of their surface in contact with the coating. Since such a small amount of the droplet is in contact with the coating the form a ball and



roll off the surface very easily. Hydrophobic coatings are also found in nature; they appear on plant leaves, such as the Lotus leaf, and some insect wings.

Contact angle is used as a measure of hydrophobicity. When a liquid and a solid are in contact, the angle between the surface of the liquid and the solid is described as the contact angle θ . The contact angle (wetting angle) is a measure of the wettability of a solid by a liquid. In the case of complete wetting (spreading), the contact angle is 0° . Between 0° and 90° , the solid is wettable and above 90° it is not wettable, hydrophobic. Due to the extremely low wettability of such surfaces, liquid drops, and in particular water drops, form a very high contact angle, are virtually spherical and roll off the surface with ease. In doing so, they carry particles which are present on the surface with them producing a self-cleaning effect.

How are hydrophobic properties tested? Contact angle on a surface is measured by a contact angle goniometer using an optical system to capture the profile of a liquid on a surface. Older systems used a microscope optical system with a back light. Current-generation systems employ high resolution cameras and software to capture and analyse the contact angle.



Hydrophobic properties of UltraTek coatings Ceramic Paint Protection is designed to be strongly hydrophobic. Polymers used in Ceramic Paint Protection have a water contact angle of 105° and oil contact angle of 58° . This strong hydrophobic effect promotes water beading, resists re-soiling and provides a self-cleaning effect.

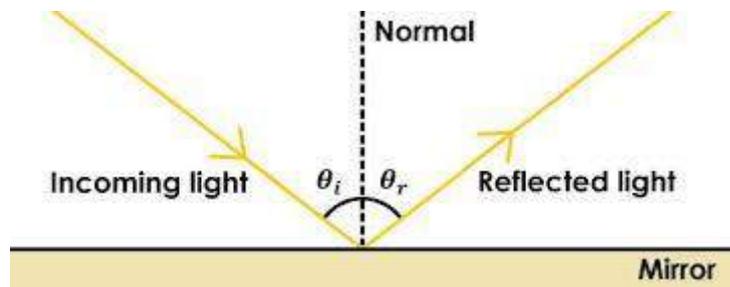
Polysiloxanes used in UltraTek Leather and Vinyl care are products also provide a strong hydrophobic effect by application of a thin, non-greasy, flexible film to the surface.

UltraTek Fabric Protection utilises a water based (meth)acrylic fluorinated C6 based polymer. This polymer is designed to not change the look or feel of the fabric, yet it provides a strong repelling effect against many commonly used fluids. See the Chemical Resistance section for more information.

GLOSS

What is gloss? Gloss is the property of a surface which measures specular reflection. Specular reflection is a light beam resulting from reflection off a surface. Gloss follows the

law of reflection which states that when a ray of light reflects off a surface, the angle of incidence is equal to the angle of reflection. High gloss surfaces are shiny and reflect most light in a mirror-like direction, while on flat paints most of the light reflects in a range of angles. Between those extremes, there are several intermediate gloss levels. Their common names, from the dullest to the shiniest, include; flat, satin, semi-gloss and high gloss.

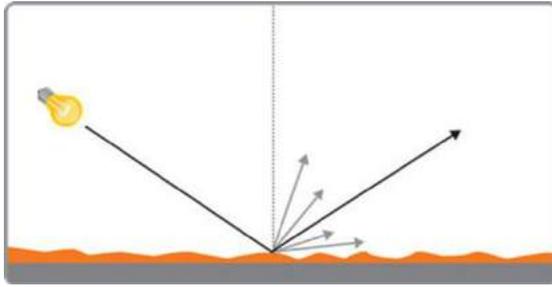


A high gloss surfaces will easily reveal surface imperfections such as sanding marks, mars and scratches. High gloss surfaces are generally more resistant to damage than flat paint, more resistant to staining, and easier to clean. Flat paint may become glossier through burnishing or staining with grease; glossy paint may lose its gloss if abraded and/or weathered.

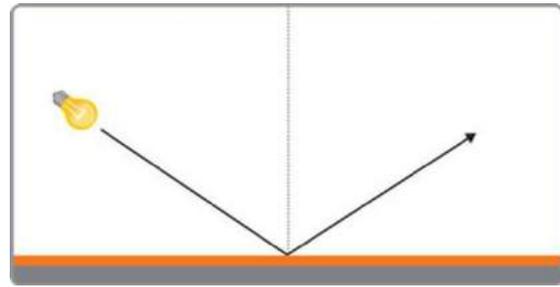
Generally high gloss surfaces are smoother compared with low gloss surfaces since scattering of the light from irregular surfaces produces a flat finish."

How is gloss measured? The glossmeter provides a quantifiable way of measuring gloss intensity ensuring consistency of measurement by defining the precise illumination and viewing conditions. The configuration of both illumination source and observation reception angles allows measurement over a small range of the overall reflection angle. The measurement results of a glossmeter are related to the amount of reflected light from a black glass standard. The ratio of reflected to incident light

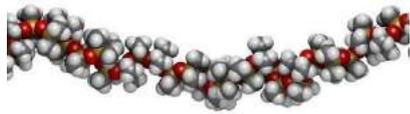
for the specimen, compared to the ratio for the gloss standard, is recorded as gloss units (GU).



Low Gloss – scattered reflected light
reflected light



High Gloss – concentrated



Gloss of UltraTek coatings Ceramic Paint Protection has been engineered to enhance the gloss of paint finishes. The thin film of polymer smooths over imperfections and rough surfaces that cause light to scatter and gloss to reduce. Vehicles coated with Ceramic Paint Protection maintain their gloss for

longer since scratches, marring, soil deposition and weathering are resisted. UltraTek Vinyl is a premium vinyl care product. It is a blend of polysiloxanes designed to enhance and restore tired vinyl surfaces without leaving a high gloss, greasy finish. Vinyl has excellent application ease and rubout as well as superior flexibility and hydrophobicity

UltraTek fabric and leather care products used for “soft” surfaces are designed not to enhance gloss but maintain the natural look of the surfaces whilst still providing protection.

WEATHERING

What is weathering? A major factor affecting the durability of coatings is weathering. Changes occur to coatings during exterior exposure to ultraviolet radiation, heat and moisture. Weathering results in deterioration of a coatings mechanical strength, adhesion, colour, gloss, flexibility and chemical resistance.

How is weathering measured? Coatings are exposed to either artificial weathering or real time weathering. Real time weathering tests are conducted in external ambient conditions over long time periods. Weathering can be accelerated artificially in the laboratory. Coatings are exposed to artificial radiation, in order to simulate the ageing processes which, occur during natural weathering or exposure to sunlight . In contrast to natural weathering, artificial weathering involves a limited number



of variables which can be controlled more scientifically, and which can be intensified to produce accelerated ageing. Test samples are irradiated using Xenon arc light and periodically moistened. Various test cycles are used depending upon the coating and performance requirements.

Weathering resistance of UltraTek Ceramic Paint Protection

As shown in the adjacent picture the weathering resistance of polymers used in UltraTek Ceramic Paint Protection have been tested using accelerated weathering tests. The photo shows



coated and uncoated panels after 3000 hours accelerated weathering testing. There is no chalking and no loss of colour or gloss in panels that use Ceramic Paint Protection polymers.

CHEMICAL RESISTANCE

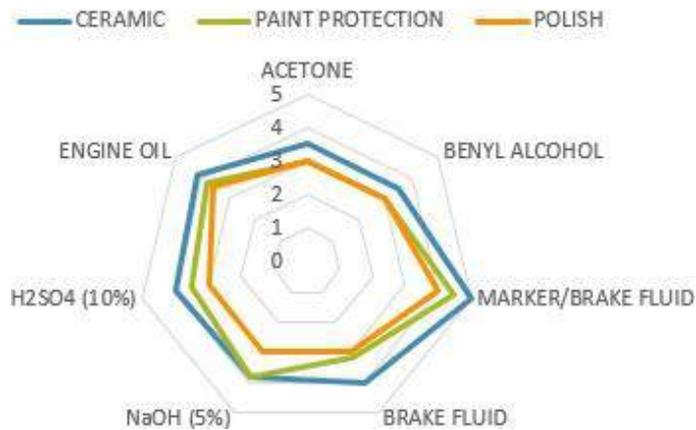
What is chemical resistance? Chemical resistance is the ability of a surface to protect against chemical attack or solvent reaction. It is the opposite of chemical reactivity. It determines a material's resistivity to corrosive or chemically damaging environments.

How is chemical resistance measured? Chemical resistance is measured in a variety of ways. At UltraTek coatings are tested by placing several drops of test liquid, or saturating a cotton ball with test liquid, on the cured coating for several hours. After the predetermined time period has passed the exposed surfaces are washed with water and detergent before being dried with a cloth. The effect of the chemicals is noted by recording by any visual change to the surface, or in the case of fabric coatings, how the liquid has penetrated the surface.

Chemical resistance of UltraTek Coatings

The diagram below shows chemical resistance of polymers used in UltraTek Ceramic Paint Protection. The blue line shows the performance that most closely matches Ceramic Paint Protection. The diagram shows that polymers in Ceramic Paint Protection provide all-round chemical resistance to solvents, oils, caustics and acids. Resistance to "permanent" markers is particularly high.

CHEMICAL RESISTANCE



Samples are numerically rated as follows:

5: No Effect – No detectable change in the material surface.

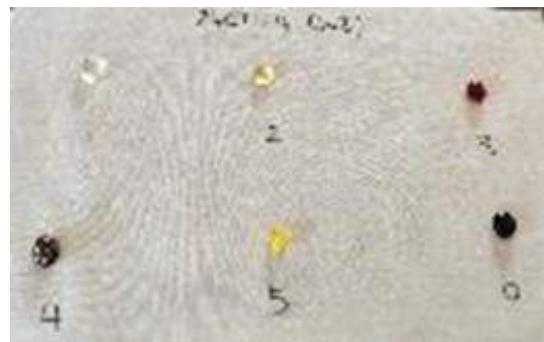
4: Excellent – Slight change in colour or gloss, no functional change or surface life

3: Good – A clear change in colour or gloss, no significant loss of surface life or function.

2: Fair – Objectionable change in appearance due to dis-coloration or etching, possible deterioration of function over an extended period of time.

1: Fail – Pitting, cratering or erosion of the surface. Obvious and significant deterioration.

In-house testing of UltraTek water based Fabric Protection system has revealed remarkable results even after 2 hours contact time. As can be seen below common fluids such as water, soy sauce, cooking oil and red wine are resisted. After 2 hours contact UltraTek product scored 93% repellence, almost complete repellence over time across all fabrics (polyester, cotton, poly/cotton, paper towel). This effect results in reduced staining and increased soil repellency.



1. Water

2. Cooking Oil

3. Red Wine

4. Orange Cordial

5. Soy Sauce

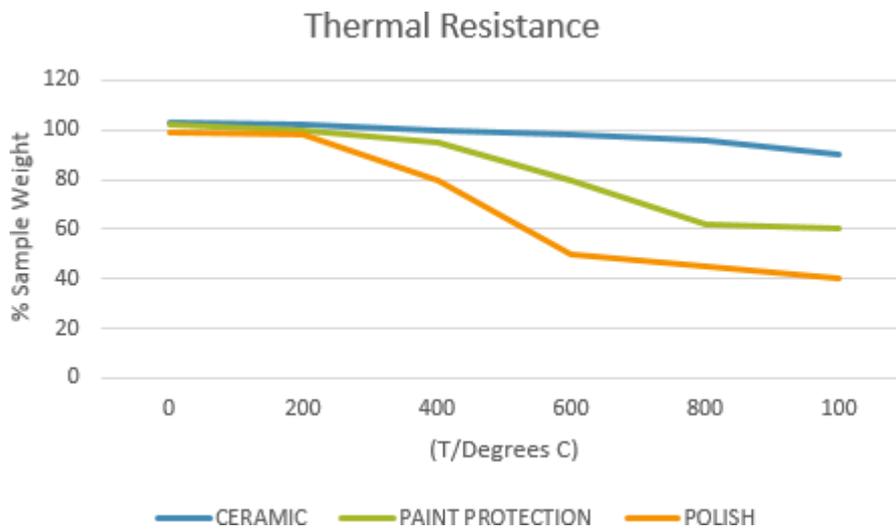
6. Balsamic Vinegar

THERMAL RESISTANCE

What is thermal resistance? Thermal resistance is a heat property and a measurement of a temperature difference by which a coating withstands degradation at high temperatures.

Why is thermal resistance important? Coatings contain chemical polymers that can be broken down by heat. Coated areas that are adjacent to areas that get particularly hot ie bonnets and exhaust systems can degrade more rapidly than other areas.

How is thermal resistance measured? There are many ways to test thermal resistance. However, polymers used in UltraTek Ceramic Paint Protection have been tested by measuring the weight loss of coated panels at elevated temperatures. Coated panels were heated to 1000°C at a rate of 5°C per minute. The % loss in sample weight was measured and compared against silicone polymers.



Polymers used in UltraTek paint protection products are rated as stable up to 600°C whereas silicone polymers began to degrade at 400°C.