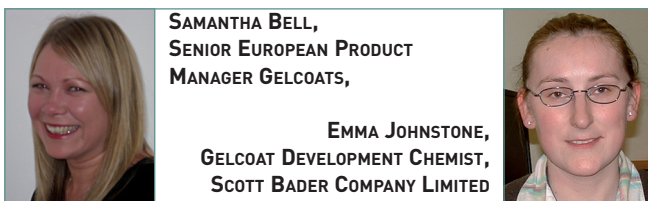


FEATURE “Resins and Gelcoats”

ISO-NPG gelcoats and barrier coats

Scott Bader is introducing two new products, Crystic LS 30PA a high performance gelcoat that offers outstanding weathering characteristics, and Crystic Crestacoat 5000PA a lightweight barriercoat with excellent surface appearance.



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It is known that ISO-NPG gelcoats are better when it comes to weatherability, but they can have some limitations with respect to their handling properties. Scott Bader's aim was to produce a superior weathering spray ISO-NPG gelcoat. The criteria for the product were:

- superior UV weathering performance in the most testing environments,
- excellent colour and gloss retention over time,
- superb water resistance with very low pick-up,
- high resistance to osmotic blistering,
- tough, long-lasting and durable surface,
- excellent handling.

All development products are put through a rigorous testing regime. To ensure the end product meets all requirements, they are tested to a “customer” environment.

The most important areas of testing are:

- 1) 12 months of Florida weathering – the harsh conditions there make that State an excellent place to test weatherability;
- 2) 12 months of blistering – as many products are specifically designed for the marine industry, they need to be resistant both to water and to blistering;
- 3) mechanical properties – the products have to be suitable for the market and for most applications;
- 4) liquid properties – these need to be correct in order to determine spray or brush application and ensure that handling is appropriate.

Weathering

The main factors contributing to weathering are solar radiation, temperature and water (moisture). Each of these involves various complications, e.g. different types of radiation, or different phases of moisture and temperature cycling. To further complicate things, airborne pollutants and acid rain can also have negative effects on coatings.

To ensure a full picture of degradation in different environments, Scott Bader implements a range of weathering tests that includes two forms of natural weathering tests and two forms of accelerated tests. The natural ones consist of 12 months of Florida weathering and a minimum of 12 months of UK weathering. These tests are time consuming and expensive, hence the need for accelerated weathering.

It must be stressed that results from the accelerated machine are used only as a ranking system and that Florida is the ultimate “decider”. The use of all these different types of weathering tests as one test is not reliable enough to determine the true nature of the product.

Measuring colour change

To ensure that results are consistent, colour change is measured in-house (even the Florida panels). The full degradation can be monitored at any time during testing (except in Florida, where degradation is only monitored at the times specified to Atlas). To measure colour change, the CIELab colour space is used to measure colour shift. The CIELab colour model is the most complete model conventionally used to describe the colours that are visible to the human eye.

Gloss and gloss retention

Gloss is defined as the ratio of the amount of light reflected from the surface to the amount of light incident on that surface at a given angle. The most common angle of incidence and reflection is 60°C. The change (loss) in gloss is represented as a percentage (this is the gloss retention):
Gloss retention (%) = Gloss at 60°C before testing/Gloss at 60°C after testing

Florida weathering tests

For natural Florida weathering, Scott Bader uses the Atlas Weathering Group site in South Florida because of its subtropical climate, which can produce harsh conditions for materials to simulate what may happen when they are used in external applications. The test is carried out using open-backed panels that are 300 mm long and 100 mm wide. The panels are placed at 5° to the horizontal, in accordance with ASTM G7 “Recommended Practice for Atmospheric

Environmental Exposures Testing of Non-metallic Material”, see Figure 1.



Accelerated weathering

When properly filtered, the xenon arc lamp simulates UV and visible solar radiation more closely than any other light source. Scott Bader uses the Suntest XLS+ machine (see



Fig. 2: Suntest XLS+

Figure 2), which is an air-cooled tabletop unit. The advantage of this machine is that different filters can be used to give different spectra; however, Xenochrome 300 filters are used with no water or humidity, hence the need for natural weathering.

Weathering results for Crystic LS 30PA

Many of the weathering results are compared against competitor materials. The graphs below show the (final) 12 months of Florida weathering and the 1000 hrs Xenon arc results for Crystic LS30PA.

These graphs show that the Florida weathering results differ somewhat from the accelerated, thus you cannot depend solely on accelerated testing. LS30PA performs consistently well in both graphs, with a low colour difference (ΔE) and high gloss level. This is an excellent balance – visually, a shift to $\sim 1.7 \Delta E$ may be quite difficult to see by the human eye.

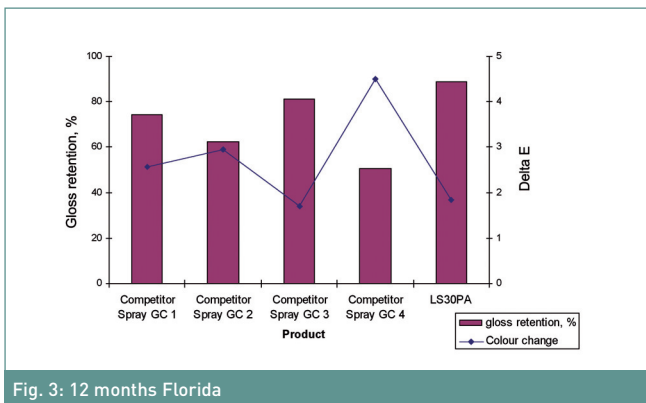


Fig. 3: 12 months Florida

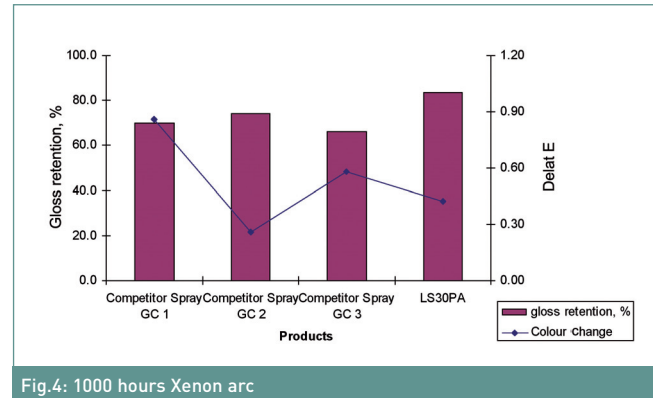


Fig. 4: 1000 hours Xenon arc

Blistering

Scott Bader has been at the forefront in supplying the UK marine market, and blistering (or osmosis) testing has been one of the keys to success in this sector. A minimum of 12 months of blistering tests were performed on Crystic LS30PA. The blister test evaluates the surface of the panels for blisters or abnormalities and measures the water pick-up. The company developed the test and has been using it for 30 years, so it is tried and true. Testing is done in house and panels are subjected to water at 40°C. Crystic LS30PA showed no sign of blistering on its panels after 12 months, and its water pick-up was minimal (see Figure 5).



Fig. 5: Blistering panel in a blistering chamber

Mechanical properties

Another area which has significant importance is mechanical properties. The gelcoat must be flexible enough to use, but hard enough to protect the structure. For the marine industry, the aim is to obtain Lloyds approval on all fully formulated products. Scott Bader has its own materials-testing department, which does all mechanical testing. Lloyds dictates that products must be tested after a post-cure of 16 hours at 40°C and have elongation >2.5%, tensile strength >40MPa, flexural strength >70MPa and water absorption $\leq 70\text{mg}$. Table 1 below shows that Crystic LS30PA meets all of the mechanical properties required for marine approval.

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Tab. 1: Mechanical properties of CrysticLS30PA (LDs post-cure)

Mechanical data		
Property	Unit	LS30PA
Tensile elongation	%	2.8
Tensile strength	MPa	52
Flexural modulus	MPa	3045
Barcol hardness	-	47
Water absorption, 4 weeks at 23°C	mg	64.7
Heat deflection temperature (1.80MPa)	°C	62

Liquid properties and handling

It is very important that any product supplied to customers have good handling properties. Therefore, the liquid properties must be optimised.

The results in table 2 below show that Crystic LS30PA has typical spray liquid properties. These possess the correct conditions for spray products, and minimise sag and any porosity issues associated with spray gelcoats.

Tab. 2: Liquid properties of Crystic LS30PA

Liquid data		
Property	Unit	LS30PA
Viscosity at 4500 s-1	poise	2.4
Viscosity at 0.6s-1	poise	250
Specific gravity	-	1.2
Gel time at 25°C, 2% Butanox M50	-	7
Flash point	°C	26

Combined with the liquid properties and the formulation, Crystic LS30PA is easier to use than most superior grade ISO-NPG's. It can be backed up in one hour and 15 minutes, and the level of tack associated with ISO-NPG's is quite low. In summary, the gelcoat demonstrated excellent weathering characteristics during extended exposure tests in Florida, with high gloss retention and low colour change. It met all the required criteria and received excellent feedback from various customer trials in leading boat-building areas.

Crystic Crestacoat 5000PA

Scott Bader has developed Crystic Crestacoat 5000PA, a superior barrier coat that was designed to improve the surface appearance in applications where print-through of fibre glass (orange peel) is apparent.

This “defect” is commonly noticed on areas where a dark gelcoat is used, on a complex mould or infused parts. Crystic Crestacoat 5000PA can be applied to reduce, if not eliminate, such “defects” (Figures 6 and 7).



Fig. 6: Panel without 5000PA



Fig. 7: Panel with 5000PA

What is Crystic Crestacoat 5000PA?

Crystic Crestacoat 5000PA is based on innovative urethane acrylate technology that is unique to Scott Bader. This unique formulation has outperformed both polyester and vinylester barrier coats in surface finish assessments. It was designed to be applied either by spray or brush. Because it is lightweight, only 600g/m² is required to meet the recommended 1-mm-thick layer.

It can be applied either to the gelcoat of the mould to improve the mould surface, or behind the gelcoat of the part. Either way, it will ultimately improve the surface finish.

Crystic Crestacoat 5000PA was also subjected to a rigorous regime of weathering, blistering, mechanical, and liquid-property tests, although wave-scanning was the main area of interest and testing for this product.

Weathering and blistering

Using Crystic Crestacoat 5000PA in parts has no negative effects on the weathering; because it is used behind the gelcoat, it is not affected by direct sunlight. A 12-month check was nevertheless performed. A 12-month blistering test was also performed, here again, with no negative effects on panel performance.

Liquid properties

Due to the thixotropic nature of Crystic Crestacoat 5000PA, a layer of only 1 mm is needed to achieve all of its surface-finish advantages (Table 3). This is a major advantage, as less is needed. Another unique result of its liquid properties is that it can easily be applied by brush or spray.

Tab. 3: Liquid properties of Crystic Crestacoat 5000PA

Liquid properties		
Property	Unit	5000PA
Appearance	-	Light blue paste
Viscosity at 25°C	-	Thixotropic
Specific gravity at 25°C	-	0.6
Stability in the dark at 20°C	Months	3
Gel time at 25°C using 2% Butanox M50	Minutes	25
Heat deflection temperature (1.80MPa)	°C	62

Mechanical properties

As show in Table 4, this product has excellent mechanical properties, which can improve laminate flexibility. It also possesses the tough, strong and flexible urethane acrylate backbone that ensures its excellent adhesive properties within a laminate.

Tab. 4: Mechanical properties of Crystic Crestacoat 5000PA

Mechanical data		
Property	Unit	5000PA
Shore hardness	-	70
Deflection temperature under load (1.8MPa)	°C	58
Tensile modulus	MPa	1050
Tensile strength	MPa	17
Elongation at break at 20°C	%	3.5

Wave-scan

Wave-scanning, a technique more commonly used in the automotive industry, is a measurement of the long- and short-wave roughness. Depending on whether something is viewed close up or far away, the surface can differ quite dramatically. The effects seen can be described as surface waviness or “orange peel”, although technically it the short- and long-wave roughness of the surface that can be seen. The short waves are observed close up and the long waves, from a distance. In figure 8 above, we can easily see that the Crystic Crestacoat 5000PA barrier coat (with VE679PA as the skin coats) is the least “rough”; therefore it has the least

print-through. Even these levels of roughness would significantly outperform many spray-painted parts in the automotive industry.

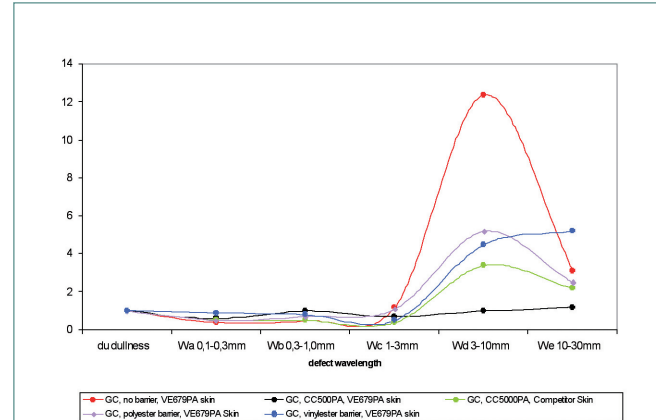


Fig. 8: Wave-scan distinctiveness of image (DOI) measurement

Conclusion

In conclusion, Crystic Crestacoat 5000PA possesses excellent surface appearance. Compared to competitor products, less material is needed to achieve the desired 1-mm thickness. The wave-scan results are proof that this product is significantly better than both polyester and vinylester barrier coats at achieving a glassy, high-definition, and deep-lustre gelcoat surface. ■

More information: www.scottbader.com