Eliminate Gel Coat Porosity with SIPERNAT® 22 LS

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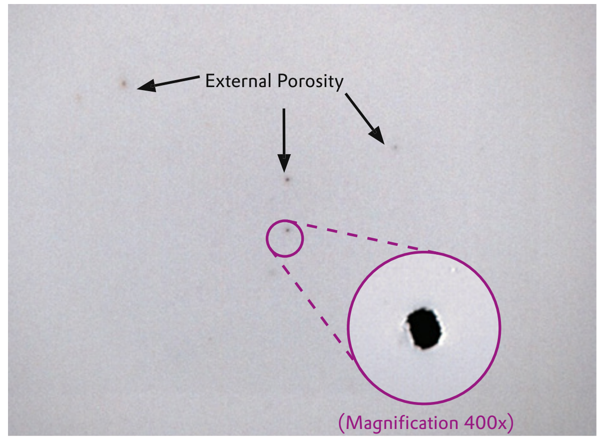
Every year, imperfections due to gel coat porosity result in substantial losses for composite manufacturers due to unacceptable parts and warranty claims. Porosity is also a problem in unsaturated polyester (UPE) repair pastes and putties where higher labor costs result. There are potentially many causes for porosity in UPE gel coats. High viscosity, gel coat thickness, cure time, air release agent loading, peroxide H_2O_2 content, spray gun operation / over-pressurization and filler loading are some of the common causes. These causes are easily corrected through proper manufacturing technique by the OEM and / or correct additive formulation by the gel coat supplier. Another major cause for the creation of porosity is the type of thixotrope utilized in the formulation. Products such as organo-clays and fumed silica are known to create porosity in UPE gel coats. The use of SIPERNAT® 22 LS can reduce gel coat porosity in filled UPE products. Due to its unique morphology and surface chemistry, SIPERNAT® 22 LS is able to allow air release while being able to provide rheology comparable to systems that use fumed silica.

Problems caused by gel coat porosity include blistering and accelerated UV degradation. In a marine environment or other liquid contact applications such as storage tanks, high porosity can cause an increase in osmostic blisters due to easier penetration of liquids.

Even resins with high chemical resistance can be undermined by porosity. Because of porosity, blistering can also occur in non-marine applications. Internal porosity can trap gasses that will expand as a result of heating and will eventually create enough pressure to cause the gel coat to blister. This is a particularly big problem in climates with a lot of sunlight and even worse with darker color gel coats. Additionally, porosity can also lead to accelerated UV degradation because of the increased surface area amount. The UV radiation is focused in the external porosity pockets and a faster rate of photo-initiation ensues. Finally, waxes, cleaners, dirt, and other foreign substances can collect in the pits, further accelerating the degradation. Figure 1 displays what typical external porosity looks like in a gel coat.

Figure 1
External Porosity



Magnification 40x

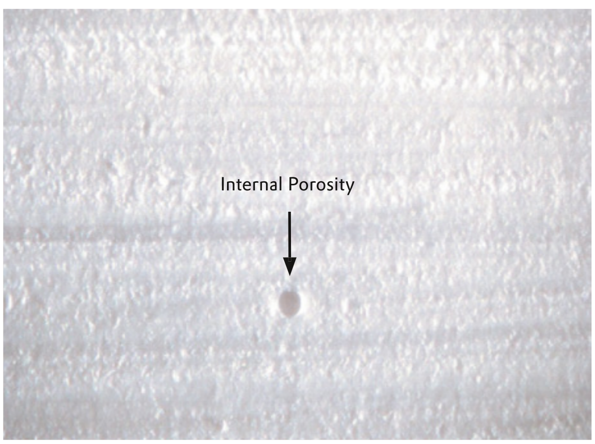
Whether reworking a boat or completing body repairs on a car, avoiding pin holes and air bubbles is key to a first class finish. Sanding and buffing a gel coat, or putty, can expose internal porosity as displayed in Figure 2. Examination under microscope of sanded gel coats has become a standard test for sophisticated OEMs such as windmill manufacturers. SIPERNAT® 22 LS can help reduce the internal porosity as well, allowing for the first class, weather resistant finish sought after in industry.

A gel coat with fumed silica, Figure 3, and a gel coat with SIPERNAT® 22 LS, Figure 4, were compared. Both gel coats were prepared the same way. 0.20 % BYK A-555 air release agent was dispersed in a low molecular weight UPE resin. The samples were then mixed with either 1.5 % fumed silica or 3.0 % SIPERNAT® 22 LS, which provides a similar rheology. A small amount of colorant was also added to aid in diagnosing the porosity. Finally, 0.10 % Cobalt (12 %) promoter was added. Prior to draw down, the samples were initiated with 1.2 % methylethyl ketone peroxide.

The figures were obtained using a microscope at 40x magnification. The brown and black dots are air bubbles trapped on the gel coat surface. The pictures illustrate the differences in porosity between Evonik SIPERNAT® 22 LS and fumed silica. The fumed sample in Figure 3 has a much higher degree of porosity than the SIPERNAT® 22 LS sample shown in Figure 4. In a competitive market that is always seeking the best quality product, this improvement can lead to a higher quality gel coat that resists blistering and UV degradation.

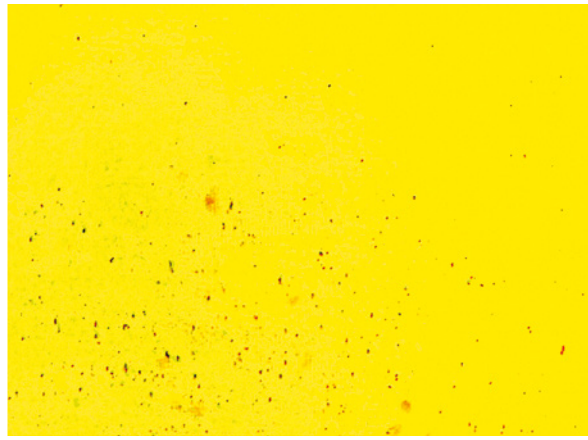
Regardless of the application, SIPERNAT® 22 LS can help improve the finish of coatings, and quality of putties, that have imperfections caused by porosity. In order to produce a well rounded optimized gel system, blends of AEROSIL® 200 and SIPERNAT® 22 LS are typically utilized for rheology control. AEROSIL® 200 has been a long time industry standard in unsturated polyester resin and is essential for creating long term viscosity stability. Looking to improve quality and cost, contact Evonik Industries AG for assistance in improving your UPE formulations.

Figure 2
Internal Porosity



Magnification 400x

Figure 3
Fumed Sample



Magnification 40x

Figure 4
SIPERNAT® 22 LS Sample

Magnification 40x

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