

# The 2-Minute Cure

By John Pfanstiehl

**H**igh-performance paint that fully cures in two minutes or less without mixing isocyanate catalysts is the promise of UV-cured paint technology. The promise has already been realized in UV-cured primers that are available to U.S. refinishers today. UV-cured clearcoats and UV-cured putties have been demonstrated at trade shows and are in field-testing and focus groups. Paint manufacturers say these and other UV-cured products are well on their way to the automotive refinish market.

## Benefits

Cure times of two minutes are a major breakthrough in scheduling, speed and throughput for a refinish shop. The benefits of faster repairs and of not needing to interrupt the repairer are significant for any bodyshop yet are even more valuable for a high-volume shop. Another significant benefit is that the technician does not have to leave the current job to begin work on another vehicle while waiting for paint to cure.

The UV-cured paints currently available offer myriad other advantages in speed and ease of use because they are applied by aerosol. This eliminates the need for measuring and mixing and makes preparation and cleaning of a paint gun unnecessary. Pot life concerns and waste are also eliminated. Additionally, many bodyshop technicians and painters have health concerns regarding the use of isocyanates and are interested in eliminating their use.

The paint manufacturers say the current UV-cured primers offer equal or better performance than the best primers in the most important parameters including adhesion and hold out. These primers can be applied directly over common automotive substrates,



***UV-cured paints promise quicker, safer paints with a curing time of less than two minutes.***

with the exception of a few plastics that need special primers. They also do not require special topcoats because they are compatible with standard topcoats made by the same paint manufacturer.

## Application

Although a number of paint manufacturers have demonstrated UV-cured paints and putties, as of press time, the only UV-cured refinish paints available in the United States are primers from PPG and NEXA Autocolor. Surface preparation for these UV-cured primers is similar to conventional two-component primers. After thorough cleaning, the surface is sanded with P400 or coarser paper. The primer is applied at 8-10 inches with four to five continuous passes to produce a film build of 3-5 mils. The primer is a translucent gray, which aids in monitoring the coverage.

Immediately after application, the UV lamp can be positioned 8-10 inches from the coated surface. Under UV light, chemicals in the paint fluoresce and the small glow from the primer further enables the technician to know that the surface is being illuminated with UV light. After two minutes, the lamp can be switched off and removed.

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# Manufacturer's Forum

## The Future of UV-Cured Refinish Technology

by John Pfanstiehl

### Akzo Nobel

According to Pieter Peters, Akzo Nobel's technical director for refinish in North America, the company is actively researching UV-cured technologies. "We have UV-cured products available in other coatings markets," Peters says. "We feel it is an exciting area of development and are working to develop products that will be beneficial and profitable for our refinish customers."

### BASF

BASF's Automotive Refinish group demonstrated UV-cured paint at the 2001 NACE Show. Participants in BASF's current customer focus groups and field trials are impressed with the UV-cured primer surfacers filling ability and curing speed. In less than eight minutes after being sprayed, the sanded film can withstand a puddle of methyl ethyl ketone (MEK), a very strong solvent. This is a testament to fullness of the UV-cure. By comparison, isocyanate products, even when the cure is accelerated by heat, are not able to withstand strong solvents early in their life. It's also worth noting that today's UV lamps are relatively safe to use, as long as reasonable care is taken. In the refinish market, the ability to obtain full and complete curing in a matter of minutes promises a major reduction in the time required for paint repairs, which can lead to significant improvements in cycle times and productivity.

### DuPont Performance Coatings

DuPont Performance Coatings' Jay Kaiser, platform manager for undercoats, stated that UV technology definitely has potential for the automotive refinish market and DuPont is actively working on it. The work is primarily in undercoats, and the goal is to create a product that is superior to current products being offered. In particular, DuPont wants to make sure the product is designed so that it will cure fully under repair facility conditions before they introduce it to the automotive refinish market.

### Montana Products, Inc.

Montana Products, Inc., an automotive finishes manufacturer that has served the industry for more than 27 years, displayed a UV-cured putty and a UV-cured primer at the 2001 NACE Show. Montana Products has been developing UV-cured putties, UV-cured primers and UV-cured clearcoats for the past two years. A major goal is to introduce UV-cured products that will be fully cured, including the surface layer that is exposed to air, while making the technology affordable, safe and easy to use.

### PPG and NEXA Autocolor

NEXA Autocolor introduced the first UV-cured primer to the U.S. automotive refinish market in 2001. The aerosol-applied primer eliminates the need for measuring, mixing and gun cleaning. Pot waste is also eliminated. The UV-cured primer is a significant advance in throughput for small repairs in body shops by drastically reducing application and cure times for undercoats. The primer can be applied over all substrates and is compatible with all NEXA Autocolor topcoats.

PPG introduced its UV-cured primer product line to the U.S. automotive refinish market in 2002. The product line includes an aerosol primer and UV cleaner used after curing. After conventional surface preparation, the primer is applied in a one-coat application. The primer can be applied over all automotive substrates and is compatible with all PPG topcoats.

Once applied to the repair area, both the NEXA Autocolor and PPG brand UV-cured primers are illuminated using an approved UV-curing lamp. The primers then reach a full cure in less than two minutes. After cure, the surface is wiped with a UV cleaner and is immediately ready for topcoat application. The performance characteristics of the UV-cured primer are equal to or superior to premium conventional two-component urethane primers.

### SEM

The need for speed in the shop has been recognized by all coatings manufacturers. In order to do this with the quality required by today's OEM finishes, unique "proven" reactive finishes must be employed. The coatings manufacturers in concert with the equipment suppliers are continually advancing what can be accomplished on the shop floor. Some of the technologies coming out today had been worked on 10 or 15 years ago. However, the availability of cost effective/user friendly delivery, application and curing equipment was not there.

### RadTech

RadTech (a non-profit organization and industry forum for advancement of UV and EB curing) now has a special Refinish Focus Group. RadTech already had an Automotive Focus Group for UV-cured applications, particularly at the OEM level and their parts suppliers. This includes clearcoat on headlight lenses, coatings on mirror housings and trim and some sealants; all were cured by high-energy UV. The ability to cure with lower energy and the possibility to offer this technology to a refinish environment has spurred RadTech to be an industry-wide association and carry the banner for UV cure into refinish. It's working on designing/developing educational programs that would flow across the industry, such as ensuring that coating suppliers do not appear to teach safety issues with cross-purposes.

Brad Richards, manager of refinish coatings R&D for BASF Corp. and a member of RadTech, says "One of the specific things that BASF is offering to RadTech is an ecoefficiency analysis of a refinish coating that is cured with UV-A lights. BASF has championed ecoefficiency as a life-cycle analysis of products from selection of raw materials, through energy consumption at various steps of manufacture and use, to the environmental, health and safety impacts on the workplace. We already have a model for the use of UV curing in the wood/kitchen cabinet industry where it is more environmentally friendly to use UV in many respects. We will have a refinish and an OEM example for ecoefficiency done by late summer."

RadTech is also interested in spreading the word on UV cure. In addition to seminars, a breakout session is planned at NACE 2003 to discuss health and safety issues as well as future potentials for UV.



*The UV-cured primer is sprayed to cover the damaged area.*

*A low-energy UV lamp is used to cure the primer.*



*The uncured layer of the UV primer should be thoroughly removed.*

*A low-energy UV lamp is used to cure the primer.*



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The top surface of the primer remains sticky because it is exposed to air and this inhibits its curing. Uncured overspray and the thin top layer are removed by wiping with an alcohol-based cleaner. The primer is then immediately ready for sanding and application of other primers or the color coat.

### Different Chemistry

Two-component paints depend on the addition of a catalyst immediately before application to chemically trigger the crosslinking of molecules, which

produces a hard-cured film. UV-cured paints have chemicals known as photoinitiators that are sensitive to certain types of UV light. When these chemicals are illuminated with intense UV light, they change into chemicals that initiate the crosslinking. In effect, the UV-cured paints already have their catalyst mixed in, and they only require strong UV light to activate the curing.

UV-cured coatings are already used extensively in other industries. The extremely fast curing speed makes them desirable for many manufactured items, including a number of OEM

automotive parts. The additional advantages include the elimination of mixing of catalysts and using isocyanates, pot life problems and waste. Manufacturing, however, has the benefit of greater control over the curing process and thereby permits the use of coatings cured by high-energy UV. Products can be taken by conveyor belt into sealed curing booths or chambers that employ very high-intensity UV lamps.

### What's Ahead

UV-cured putties can have the same advantages as rapid curing, no mixing and reduced waste. UV light, like visible light, has a limit in how deep it can penetrate into putties. The first generation of UV-cured putties will likely be designed for skim coat and small repairs with depths under 100 mils.

Basecoats are designed to cover and hide the undercoats, so by their very nature they should reflect light and keep it from penetrating. This presents a technical problem because UV light would have to reach the lowest layers of the basecoat, or very close to this, to effect a full cure. At the present time, no UV-cured basecoats for the refinish market are coming up in the near future.

UV-cured clearcoats are a different story. UV light can penetrate clear paint, but automotive clears are designed with additives that block UV light to prevent damage to basecoat colors and delamination. Paint companies are actively working on this issue because of the substantial benefit of a clearcoat that can be cured, and if needed, buffed or sanded, after only two minutes.

Auto manufacturers, too, are actively investigating the use of UV-cured paints because of their fast curing and other benefits. As a result of their controlled manufacturing environment, vehicles could be taken though a light-sealed paint booth that is illuminated with extremely intense

UV light. You may see new vehicles with UV-cured paints in the not-too-distant future.

## Finding the Right Lamp

The only piece of equipment required to begin using UV-cured paints is a UV lamp. A dedicated portable UV lamp stand is very desirable because it will safely store the lamp, hold the lamp during warm-up and position the lamp over the coated surface during curing. There are a number of UV lamps on the market, so check to make sure the paint manufacturer approves the lamp you are considering or they may not warranty the paint. If possible, inspect the lamp and the stand at your jobber, training classes or other body shops to check the quality and make sure it will be suitable for all of your applications. The cost of UV lamps has decreased substantially during the past year to the point where it should not be an obstacle for even smaller shops. Also, check the cost of replacement items such as the bulb, the filter glass (lens), the air filter and the reflector. Prices vary substantially between manufacturers and replacement parts are not interchangeable between different models. They'll have to be purchased from the original manufacturer, and you don't want to be unpleasantly surprised when parts are needed.

Most UV lamps are UL listed. Recently, UL decided to make a new "commercial" category for classification of UV-curing lamps. The most noticeable change is the addition of a "shutter" to cover the lens in case the user chooses to leave the light on when it is not positioned over the coated surface.

## UV Lamps vs. Infrared Lamps

UV lamps use a relatively small-high intensity discharge (HID) bulb.

Typically, the bulb is made of quartz glass, is filled with mercury and traces of other elements and has two electrodes. A power supply creates a high-voltage starting current to strike an arc between the electrodes. As the temperature of gases inside the bulb increase, the atoms begin to emit UV light, visible light and infrared light. During this warm-up period, the amount of visible light is small at the beginning but builds to a high intensity generally within about a minute.

Depending on the manufacturer, full intensity is achieved in two to five minutes. You may have seen a similar start-up delay in streetlights, many of which are also mercury vapor lamps.

The bulb is positioned inside a reflector that collects and focuses the light toward the lamp opening. The opening is covered with a special tempered glass designed to filter out UV-B and UV-C radiation, which is considered more harmful to people than the UV-A radiation that cures UV-cured paints. A small fan is typically located in the lamp head to prevent the bulb from overheating and to reduce the temperature of the enclosure, preventing user burns. The fan should have a replaceable filter to prevent overspray and body shop dust from getting into the lamp and onto the bulb, reflector or glass.

Like infrared lamps, UV lamps also produce infrared radiation, but the amount of infrared radiation is significantly less. Although a UV lamp will heat up the surface at which it is pointed, the amount of heat generated is relatively small and the heating is not a significant part of the curing process. UV lamps should not be used for baking conventional paints—this would be slow, inefficient and is not cost effective. And infrared lights simply will NOT cure UV-cured paints due to the lack of intense UV output.

## Lamp Life and Maintenance

One of the good features of a UV lamp is that the bulb is relatively shock proof. Unlike an incandescent light, there is no fragile filament that can easily break. Compared to fluorescent lamps, the HID bulb of a UV lamp is durable; it will seldom break or burn out and leave you stranded. HID bulbs slowly decrease in light output over time. Some UV lamp manufacturers have hour-meters and recommend bulb replacement at 500 hours of use. The number of hours used is by no means a perfect measure of bulb life because it does not account for the number of start-ups. Start-ups have an equally significant effect on bulb life. There are no conclusive data, but a rule of thumb to maximize bulb life is to turn the lamp off immediately after use unless it will be used again within the hour. This also minimizes stray UV radiation, heat buildup in the workplace, energy use and makes it easier to handle or move the equipment. As mentioned, a UV bulb will rarely leave you stranded; as it ages it may become necessary to illuminate the surface for an extra 30-60 seconds to produce a full cure. If you notice that the lamp is taking longer to cure the paint, order a new bulb and just illuminate the paint for a little longer time period until the new bulb arrives.

Maintenance is easy. Before turning the lamp on, inspect the filter glass for any dust, fingerprints or dirt. If needed, clean the filter glass as specified by the lamp manufacturer. Any contamination will reduce the light output and can create thermal hot spots that may damage the glass. Cleanliness is even more important on the inside of the glass, the reflector and the bulb itself. You should only handle the bulb with a clean cloth or paper towel. Change the lamp's air filter whenever it appears dirty to prevent overspray or body shop dust



from being sucked into the lamp and being deposited on the bulb, reflector or glass.

### Safety

UV lamps are very safe compared to the other equipment used every day in body shops, such as oxy-acetylene torches, welders, lifts and die grinders. However, UV lamps emit strong UV-A radiation that is invisible, along with the visible light they produce. UV-curing lamps have to emit UV-A light in greater intensity than the same UV-A light in sunshine that falls on you in the summer. UV light, even UV-A, which has been considered the safest, is known to accelerate aging of the skin over time and can produce burns or skin cancer under intense or prolonged exposure.

Safety rules are simple. Never look directly into the lens of the lamp when it is turned on. Do not let the lamp's light directly illuminate your skin.

When the lamp is on but not illuminating a panel, make sure no one else can look directly into the light or will be illuminated by it. It is prudent to cover exposed skin and wear UV-absorbing goggles when the lamp is on and you are near the lamp.

To put this into perspective, the maximum amount of UV light directly reflected off a primed aluminum panel (aluminum substrates reflect the most UV-A) at a distance of 12 inches (closer than anyone would be) is a less than 10% of the amount of UV-A from sunshine on a summer day in Florida.

### Conclusion

A revolution has begun in refinish coatings that delivers much faster repairs along with other efficiencies for bodyshops. The UV-cured paints that are already available can be cured in as little as two minutes. That's just the start; paint manufacturers are actively working on a number of other

## ANSWER TO A UV PRAYER

I learned the error of my ways.  
Wow, a job log really pays!  
Keeping track of Joules and Watts  
Can really help my process lots.  
I've reduced scrap and life is good.  
My stuff is curing like it should.  
Start or stop? Relamp or not?  
These are things I now can spot.  
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Tell me where I need to be.

If process control is your goal, it's time to call EIT. We have the products, the experience, and staff - both in the field and in-house - to help you document, achieve and maintain control of your UV process.

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