

AUTOMOTIVE UV CURING: PAST, PRESENT, & FUTURE

Kevin Joesel

Heraeus Noblelight Americas LLC



Heraeus

Why Should I be interested in UV Technology?

FAST!

PROPERTIES!

COLD CURING!

GREEN!



Drivers for UV Curing

- Increased production speed, fast and cool cure
- Improved physical properties, product performance
- Environmental compliance, green technology, reduced energy requirement
- Cost-effective, lower applied cost, less waste, reduced WIP, less floor space

Thermal vs UV

It is all about the difference in reaction rates

In very general terms, the rate of reaction for the free-radical reaction is 10^6 times faster than a condensation reaction. One million times faster! If the curing of a coating, ink, or adhesive is the rate limiting step in your process, you have to consider UV curing technology. - Dr. Robert Matheson, DuPont



UV curing is used extensively in many graphics arts printing applications such as labels -- for the printing inks, adhesives and the release coatings on the release liner, and for slip resistant coatings on pet food bags, inks and overprint varnishes on food packaging, coatings on engineered functional films, and for ink jet digital printing to name a few.



UV Industrial Coatings

UV coatings are used for protective coatings on metal pipe, bottom rim coating on aluminum cans, and, one of the newest applications, coil coatings on steel.



Automotive Past: Underhood Component



Dodge Durango that used a UV powder on the radiator. The radiator was painted black because it was highly visible through the grill. They added finishing onto the end of the line. UV powder provided a low temp cure that didn't damage plastic components and high temperature performance.

Automotive Past: Body Side Molding



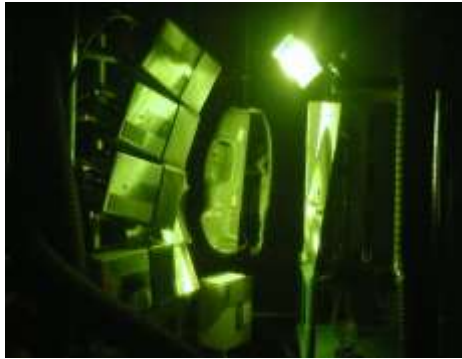
UV cured coatings on extruded PVC body side molding from the 1990s was tough and flexible. Very difficult to do with a conventional coating, and it also protected the PVC from yellowing (UV protective properties in a UV cured coating.)



Automotive Past: SMC Primer Surfacer



Ford F150 with the king crew cab that had SMC with a UV cured primer surface called “Dynaseal”.



Automotive Past: SMC Primer Surfacer/Dynaseal®



First commercial installation was on a fascia line and operational for 2 model years. The primer was “painted like steel”. FTQ on the line was >99% because the coating did not pick up dirt in the oven. Repair equipment never used, surface pops eliminated.



Automotive Past: SMC Primer Surfacer/Dynaseal®



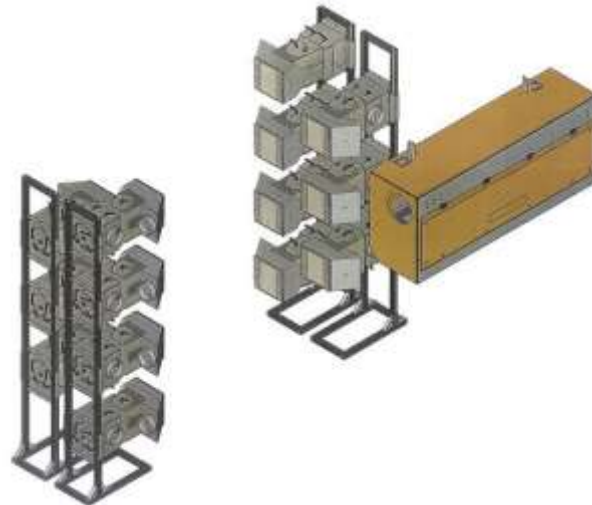
Production moved from the fascia line shown previously to a dedicated facility that had a large part window and to do multiple parts. This was the largest 3D UV cure installation with a very large part window, up to 36" x 70" parts.



Automotive Past: UV Clearcoat (Pilot)



At left is the Herberts/Dupont/Axalta pilot line in Wuppertal, Germany that was capable of dual curing (Thermal + UV) clearcoats. Though not commercialized, DuPont and BASF developed a process and coatings. The rendering below shows the lamp solution.



Automotive Present: Headlamps



Automotive headlamps – lenses and reflectors are the largest UV curing application within automotive.

Automotive Present: Headlamps



Headlamp Lens
UV curing station
on the finishing
line. Shows the
UV tunnel or
curing zone.



Reflector is
cleaned/washed,
basecoat flow coated,
flushed and cured.
Next it's metallized in a
vacuum chamber with
a silicate inorganic
coating deposited
under vacuum to
protect the metal.



Automotive Present: Glass

Automotive glass uses UV cured inks (silk screened) onto glass and then the glass is placed in alehr to fuse the ceramic pigments or conductor into/onto the glass. Below is the UV curing station for curing coatings on the glass prior to further shaping processes.



Automotive Present: Brakes, Interior Parts (Piano Black)



Brake discs shown left get a UV coating applied to the disc and cured - a very fast process.



Shown at right, the UV curing station on a line to cure interior piano black parts.



Automotive Present: UV Post-Cure Films



UV post-cure films and UV silk screen graphics for interior applications.



Automotive Present: UV Post-Cure Films

UV post-cure films seeing continued growth due to need for scratch and mar resistance of decorative yet functional parts with integrated electronics.

HIGH PRESSURE FORMING | EXAMPLE

AUTOMOTIVE



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HIGH PRESSURE FORMING | EXAMPLES

FUNCTIONAL



Automotive Present: UV Post-Cure Films

HIGH PRESSURE FORMING | MACHINERY PAMK

niebling
Formtechnologie

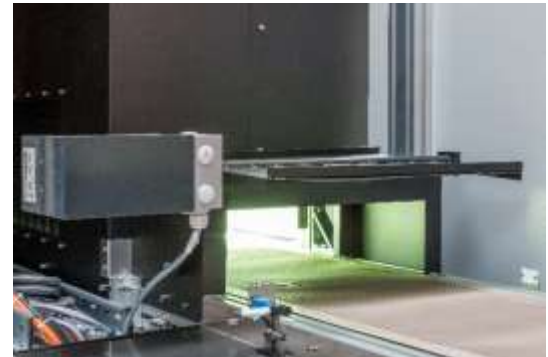
- . Detach protective film
 - . Pick-and-Place
 - . Barcode Scanning
 - . Heating
 - . High Pressure Forming
 - . UV-Curing
 - . Punching
 - . Camera Inspection
 - . Pick-and-Place
-
- . fully automatic production
 - . cycle time approx. 10-15 sec.



Example of a highly integrated high pressure forming and in-mold decorating machine for a turnkey process solution.

Automotive Present: UV Post Cure Films

Example of a UV curing station where parts are loaded and unloaded from the molding machine via robots.



Automotive Present: PVD Processing

oerlikon
baizers

ePD

CHROME LOOKING PLASTIC
METALLISATION ON A NEW LEVEL



A long time in development, but is being used for interior automotive parts. Shown below is a fully integrated system.

INUBIA I 6 & I 12

THE FULLY INTEGRATED AND AUTOMATED SOLUTION
FOR HIGH-VOLUME PLASTIC METALLISATION

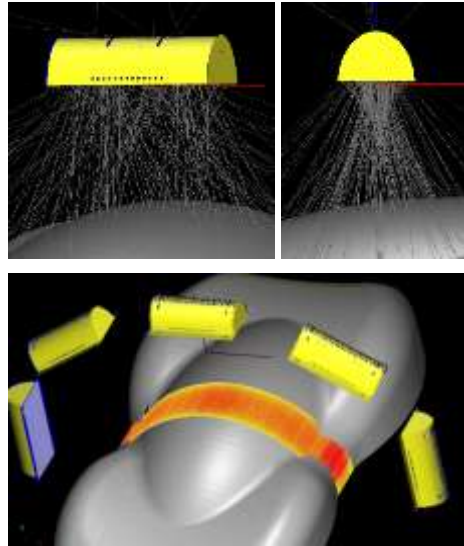


Automotive Future: Finishing 3D Printed Part



Pilot for post curing of UV 3D printed, additive manufactured parts. Can also cure UV coatings on the completed part.

Automotive Future: Curing Process Simulation

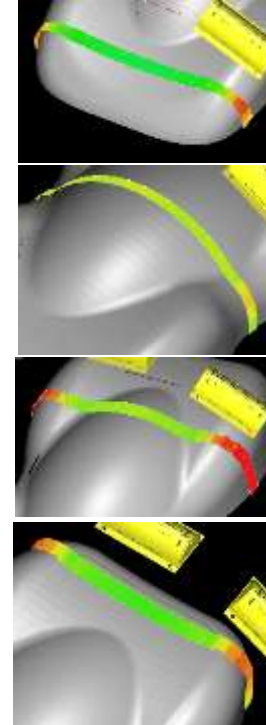


Irradiance (mW/cm^2)

■	2000 - 2500
■	1500 - 2000
■	1400 - 1500
■	800 - 1400
■	400 - 800
■	0 - 400

Total Energy for 15 fpm (mJ/cm^2)

■	6613 - 8266
■	4960 - 6613
■	4629 - 4960
■	2645 - 4629
■	1323 - 2645
■	0 - 1323



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- **The benefits of UV curing are mostly derived from the speed of reaction.**
- **UV curing is a proven and economical solution for many industries and applications.**
- **UV curing is a long established process for automotive coatings.**
- **UV applications continue to grow as new coatings are brought to market.**
- **UV 3D curing has a multitude of solutions.**
- **UV curing is an “enabling” technology.**

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BASF

SAE

RadTech International

Bayspring Consulting

Ford Motor Company

Kevin Joesel
Heraeus Noblelight America
910 Clopper Road
Gaithersburg, MD 20878

kevin.joesel@heraeus.com
248-730-2986 (m)