AUTOMOTIVE UV CURING: PAST, PRESENT, & FUTURE

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

Automotive Past: SMC Primer Surferacer
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.
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.
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 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, flashed and cured. Next it’s metallized in a vacuum chamber with a silicate inorganic coating deposited under vacuum to protect the metal.
Automotive glass uses UV cured inks (silk screened) onto glass and then the glass is placed in a lehr 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.
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.
UV post-cure films and UV silk screen graphics for interior applications.
UV post-cure films seeing continued growth due to need for scratch and mar resistance of decorative yet functional parts with integrated electronics.
Example of a highly integrated high pressure forming and in-mold decorating machine for a turnkey process solution.
Example of a UV curing station where parts are loaded and unloaded from the molding machine via robots.
A long time in development, but is being used for interior automotive parts. Shown below is a fully integrated system.
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.
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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