



UV Coatings for High Volume Production:
Faster. Smaller. Cleaner.

Introduction

My Name:

- Rich Leonard

Current Role:

- Sales Director (U.S. based UV Coatings company)

Experience:

- Thin film coatings and surface treatments - 28 years.
- Education - Materials Science, Metallurgy, Applied Technology
- Career - Production Manager, Process Manager, Product Manager, and Sales.

Purpose at CTT Summit:

- Increase awareness of sustainable UV cured coatings for the U.S. manufacturing sector.



UV Light/Energy Application Diagram



HOSPITAL

UV CURE

SUNLIGHT

HEAT

395 LED

VUV (Vacuum UV)

Wavelength: 100 – 200 nm
Energy: 6.2 – 12.4 eV
Application: Matting, UV oxidation, surface activation, -modification, -cleaning, -annealing, ozone production

UVC

Wavelength: 200 – 280 nm
Energy: 4.4 – 6.2 eV
Application: Matting, disinfection, UV oxidation, Surface activation, -modification, -cleaning, -annealing, luminescence, material testing, sun simulation, ink hardening, paint drying, photochemical reactions, spectroscopy, laser excitation

UVB

Wavelength: 280 – 315 nm
Energy: 4.0 – 4.4 eV
Application: Medicine, luminescence, material testing, sun simulation, ink hardening, paint drying, photochemical reactions, spectroscopy, laser excitation

UVA

Wavelength: 315 – 380 nm
Energy: 3.3 – 4.0 eV
Application: Tanning, luminescence, light therapy, forensics, authentication testing, UV polymerisation, catalysed disinfection, material testing, sun simulation, ink hardening, paint drying, photochemical reactions, spectroscopy, laser excitation

What are UV Coatings?

Definition

- Unique coatings which cure when exposed to UV light energy (instead of heat energy).

Composition





- **Oligomers:** pre-polymer resin.
- **Monomers:** low weight compounds that react with oligomers.
- **Photoinitiators:** absorb UV light which initiates reaction.
- **Additives:** enhance specific properties.



Basic Mechanism

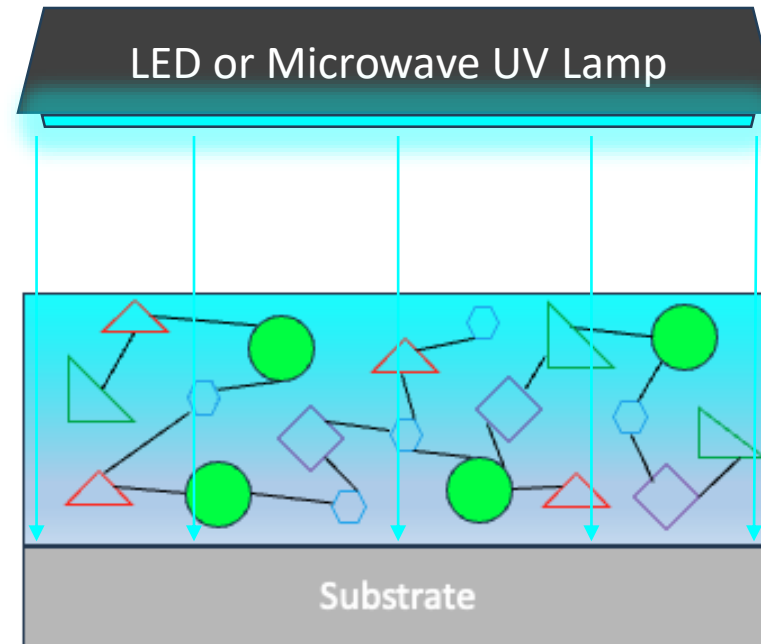
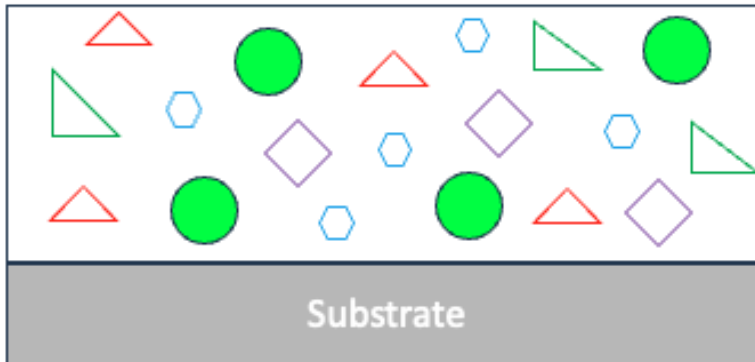
1. UV energy penetrates the coating and activates photoinitiators.
2. Photoinitiators absorb UV energy and decompose to form reactive radicals or cations.
3. The reactive species cause monomers and oligomers to link together forming long polymer chains (polymerization).
4. The chain reaction continues until the coating has fully cured.

Nearly Instant UV Curing Process

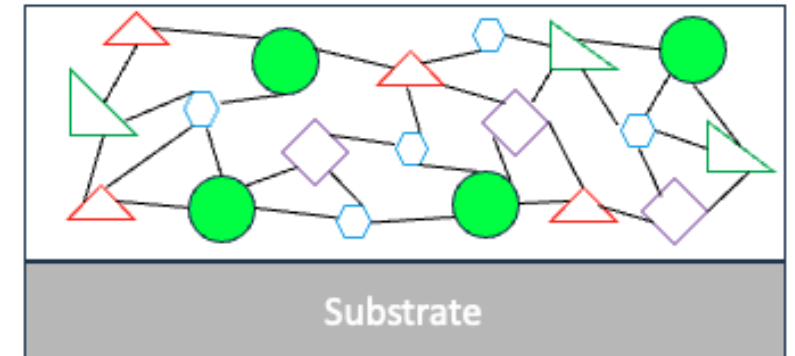
-  Oligomer
-  Monomer
-  Additives
-  Photoinitiator

UV Irradiation Curing
(fraction of a second!)

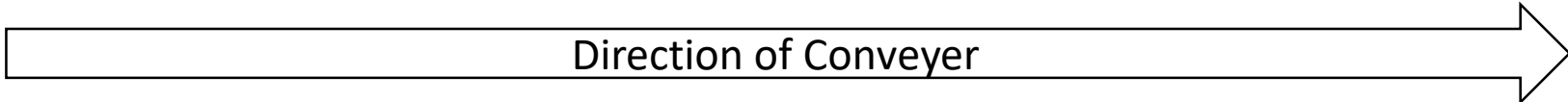
UV Coating in liquid form as applied by spray, vacuum, roller, dipping etc..



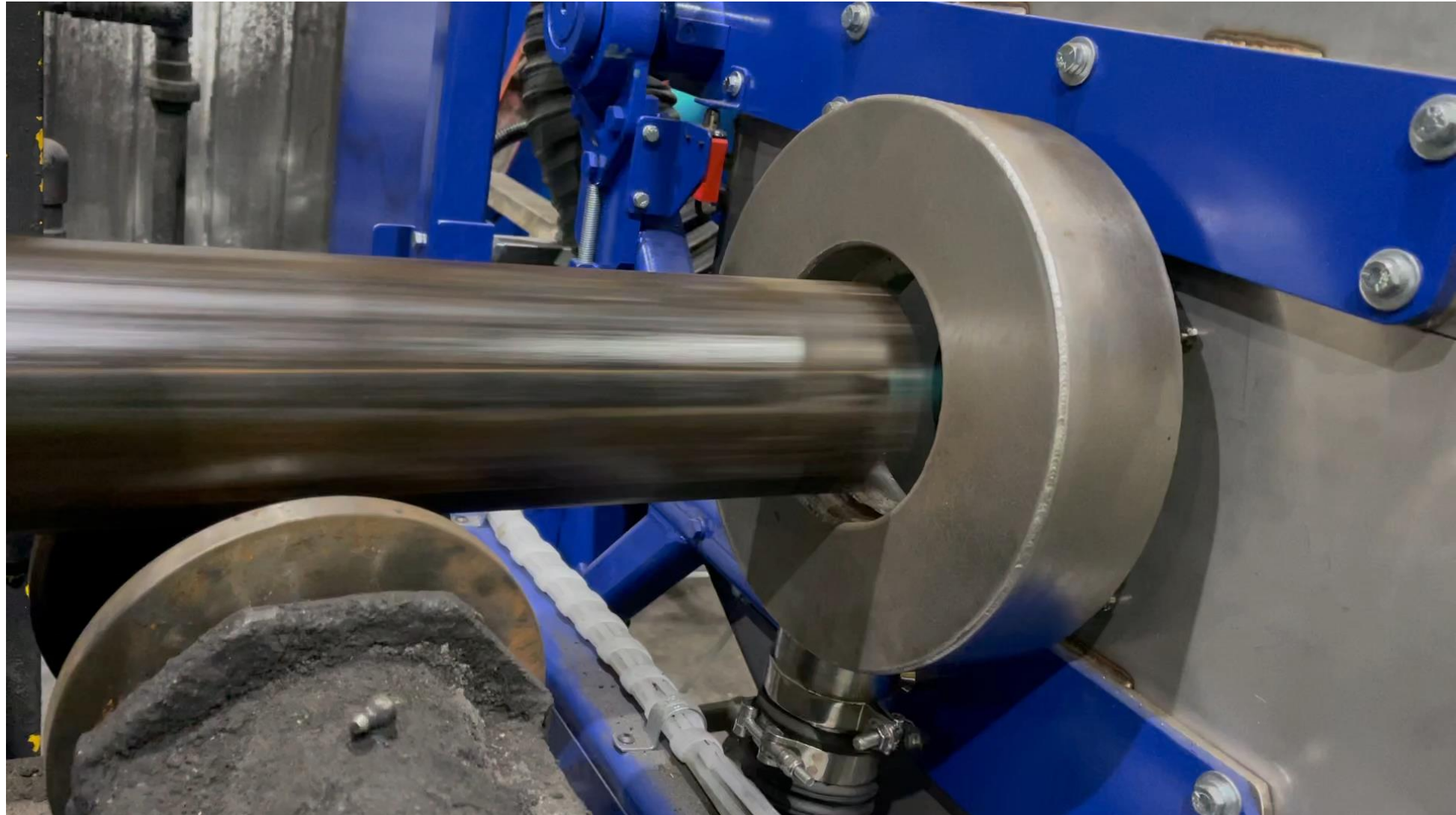
UV Coating is now fully cured/dry
solid cross-linked polymer chains.
(Epoxy, Urethane, Acrylic, Polyester)



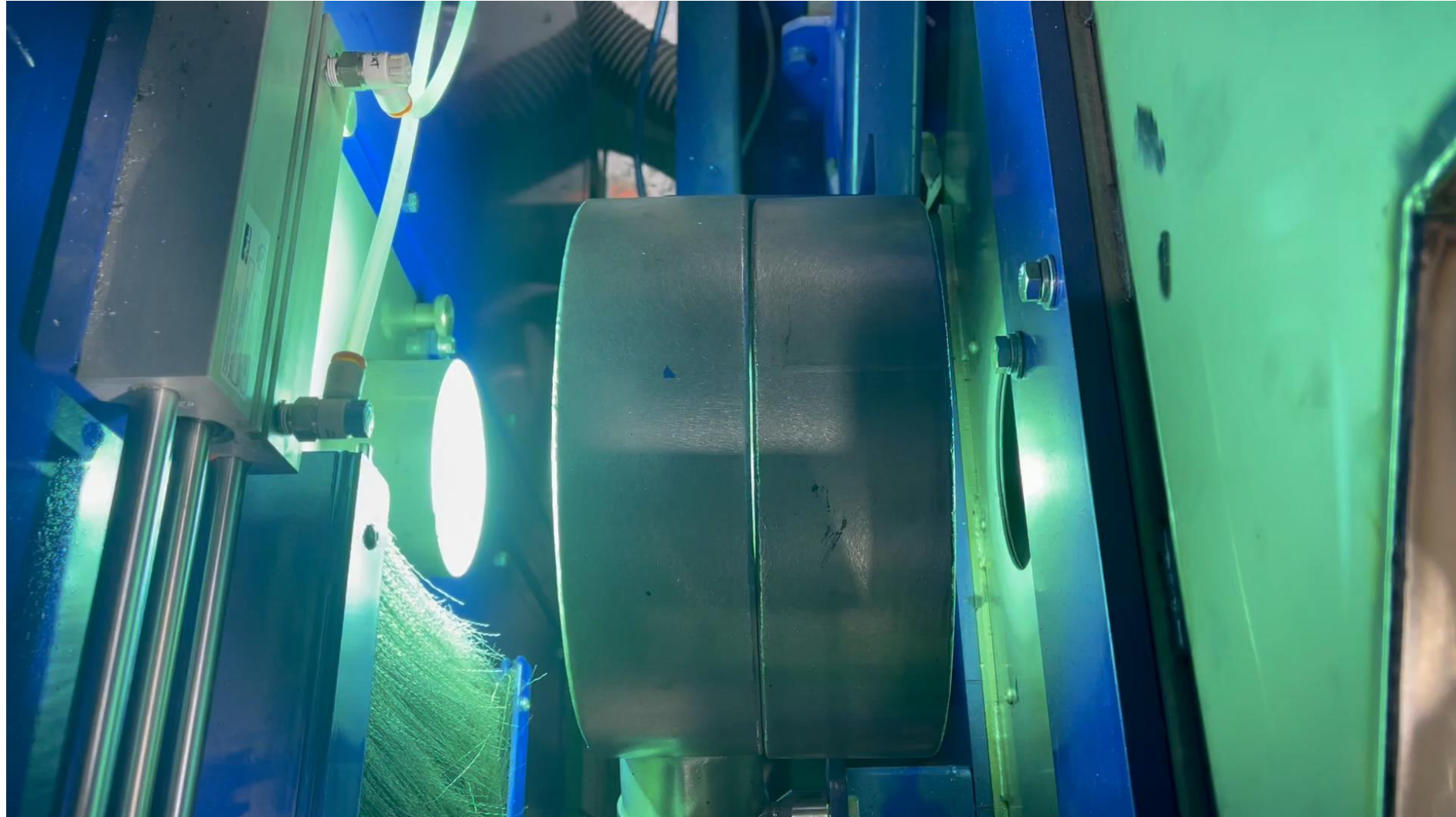
Direction of Conveyer



UV Coating of Pipe-400ft/minute



UV Coating of Pipe-800ft/minute



Benefits of UV Coatings

- **Instant Curing:** Reduced production time, no drying stage.
- **Faster Line Speeds:** Increased throughput.
- **Small Footprint:** Less equipment and less material.
- **Cleaner:** Non-volatile, non-flammable, less waste, no evaporation.
- **Durability and Performance:** Less corrosion, wear, and weathering.
- **Cost-Effective:** Reclaimable (99% efficient), lower energy costs, rapid ROI.
- **Appearance:** Glossy or matte, clear or opaque, metallic, wide variety of colors.



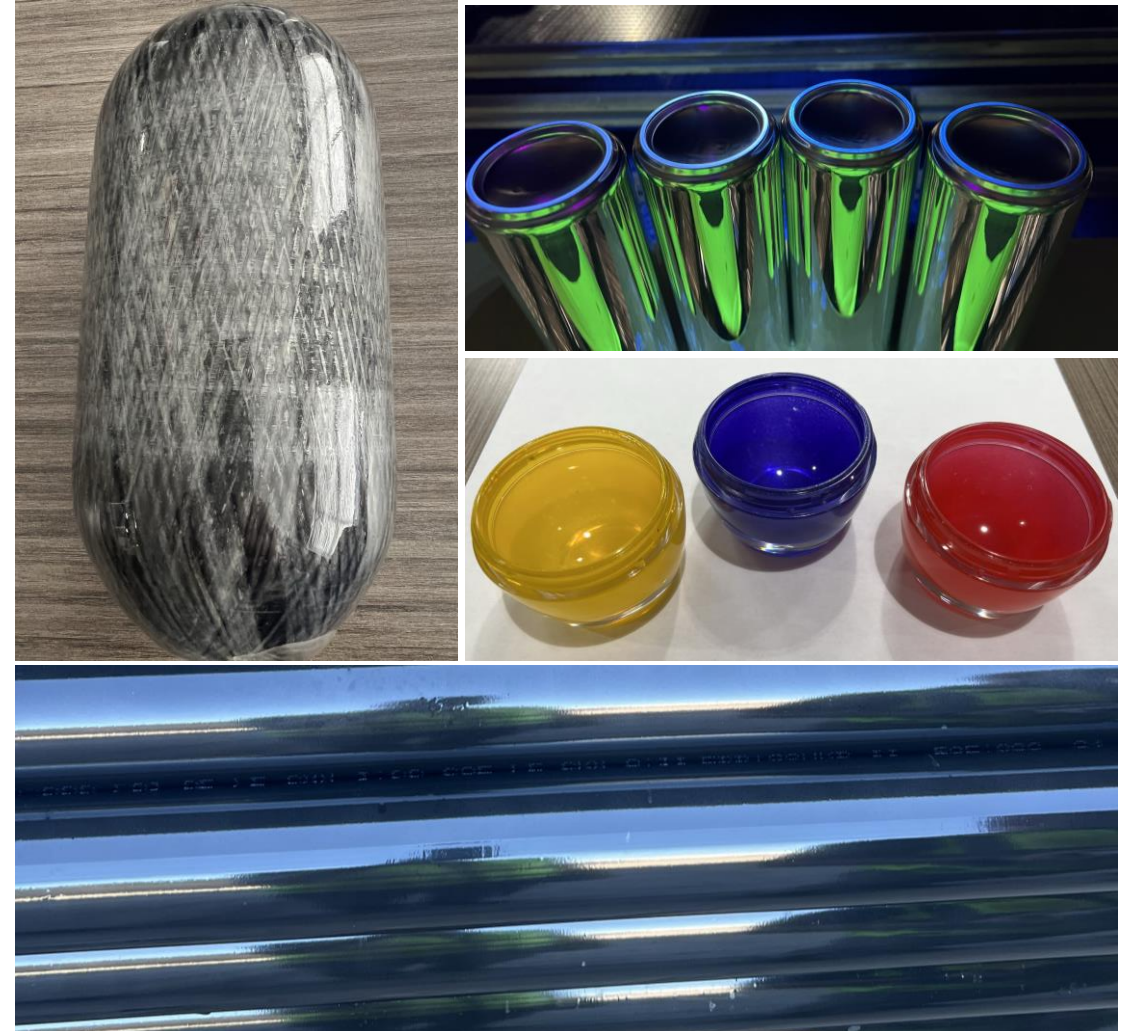
Suitable Substrates for UV Coatings

Substrates:

- Plastics, Metals, Wood, Glass, Paper, Textiles, Ceramics, Composites

Surface Preparation:

- Substrate and application dependent:
 - Scale/dust removal if needed.
 - Cleaning if needed.
 - Drying if needed.
 - Heating if processed in a cold environment.
 - Plasma etching for certain plastics.



UV Coated Examples: Fiberglass Bottle, Aluminum Cans, Plastic

U.S.A. is Leading the World in UV Innovation

Traditional Industries for UV

Include:

- Printing
- Wood Finishing
- Medical Devices
- Consumer Goods
- Optical Wear
- Electronics



U.S. Industries leading the charge for UV

Innovation:

- Renewable Energy (Solar Tube)
- Beverage Containers (LED UV)
- Building/Construction (sprinkler pipe, conduit, fencing, sewer pipe, fiberglass rebar)
- Health/Beauty (metallizing)
- Oil/Gas (Pipe)



UV Performance vs. Galvanized Steel - Corrosion

ASTM B117 Salt Fog Test – G90 4X4 Solar Tube

Compare: Bare G90 vs. UV 0.5 mil thick



Bare G90
0 Hours



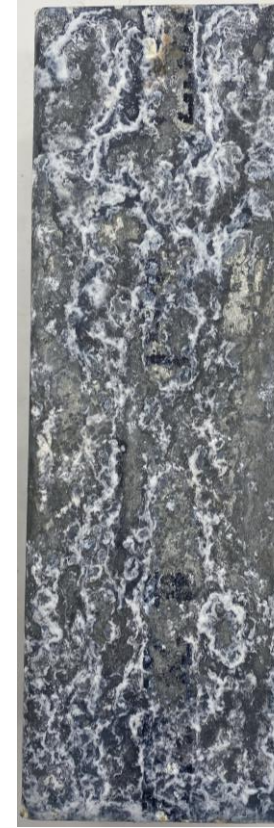
UV 0.5mil
0 Hours



Bare G90
360 Hours



UV 0.5mil
384 Hours



Bare G90
720 Hours



UV 0.5mil
792 Hours

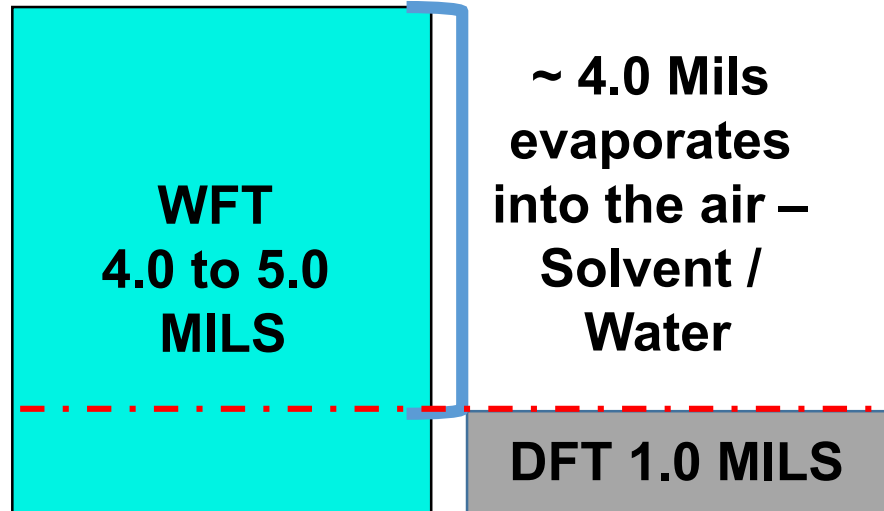
Comparison UV vs. Water-based Coating

UV wet film thickness to dry film thickness is 1:1

Water-based WFT to DFT is about 4:1

WATER-BASED COATING

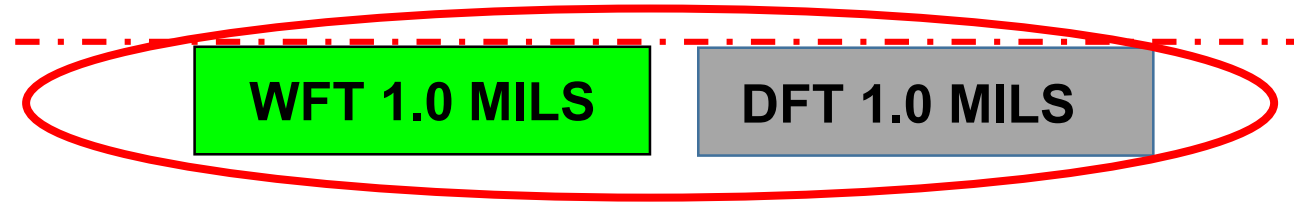
~22% SOLIDS



UV COATING

100% SOLIDS

NO EVAPORATION



UV vs. Water/Solvent based coatings

UV Coating emits no VOC's and no HAP's

Water-based coatings contain 2.2lbs of VOC's/gal.

- Based on usage of 700/gal per month.
- **VOC reduction of 55,440 lbs/year with UV coating.**

Note:

- Permits are often required to emit VOC's or HAP's which adds cost.
- Check with local environmental authorities for more information.



UV vs. Water/Solvent based coating – less waste/mess



Water-based excess waste.



Same line after switch to UV.

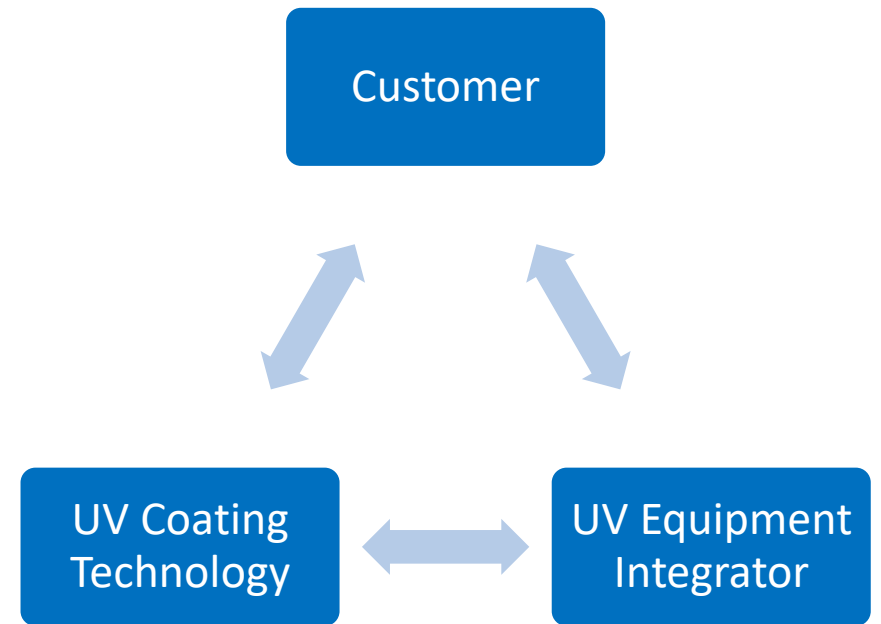
UV Implementation Process

Step-by-Step Guide:

1. **Contact an experienced expert for a consultation.**
 - Communicate needs and specifications.
2. **Work in tandem with a UV Coating company and Equipment Integrator**
 - From early planning through start of production and beyond.

Your UV Coating company should offer:

- **Customized Solutions:**
 - To match your specific needs.
- **Support in choosing the right types of technology:**
 - Equipment (LED vs. microwave, Spray vs. Vacuum etc..)
- **EHS training:**
 - Easy ways to avoid excessive skin contact etc.. (UV Coating is a skin irritant)
- **QA training and instructions:**
 - Adhesion checks, thickness checks, curing etc..
- **Recommended practice instructions:**
 - To maximize your ROI and minimize downtime, quality issues.
- **On-site startup support for your entire team.**
 - In tandem with equipment integrator.
- **Ongoing process support after startup.**
 - Regular visits to check coating quality and be an extra set of eyes.
 - To be sure your expectations are met for you and your customers.



UV is a Process!

UV Coating Summary

- Smaller
- Faster
- Cleaner
- High ROI
- Many attractive colors and finishes.
- Leading edge technology for U.S. manufacturing.
- Be sure to work with the right partners for a successful outcome.
 - UV Coating Company
 - UV Equipment Integrator

Questions?



Thank you.