UV TECHNOLOGY

A GATEWAY TO CLEAN AIR

By Greg Trojan

> "The superior man seeks what is right; the inferior one, what is profitable."
>
> — Confucius

INTRODUCTION

Today, it is widely acknowledged that emissions of greenhouse gases by human society are causing climate change on a global scale.

Although the precise impacts are not known, it is expected that climate change will cause rising sea levels, changing precipitation patterns, thinning of polar ice caps, heat waves, floods, droughts, water shortages and disruptions of forests and agriculture.

With a new sense of urgency and new efforts to reduce greenhouse gas emissions, the world's industrialized nations have to look beyond their self serving interests and work together to secure our children's future.

Environmental friendly technologies have been around in some industries for decades, however, the adoption of these technologies have been slow and pain staking.

This is particularly true in the coating industry which is the third largest emitter of greenhouse gases after energy and transportation.

The challenges faced by industry are major capital expenditure, employee training and re-qualification of new coatings by their clients.

The impetus needed to overcome these challenges may now be found in the current energy crunch.

As the price of natural gas soars, the cost of operating curing ovens are rising. For companies that outsource their finishing requirements the rising cost of transportation might present an even greater challenge, particularly when the cost of transportation exceeds the cost of coating.

As we are quickly coming to the point, as energy costs continue to rise with no end in sight, that the change to UV technology will become not only a more practical and attractive option but will be mandated by an ever cost conscious global market.

UV TECHNOLOGY

Zero emission ultraviolet UV energy curing has been in commercial use since the mid 1960. The environmental benefits of ultraviolet technology are well documented in the area of volatile organic compounds (VOC) and hazardous air pollutants (HAP) emission reduction in the industrial finishing industry. However, they are not even on the radar for a great majority of business executives making the decisions.

Many of the challenges anticipated by those executives are based on myth generated in the early stages of the technology. These arguments have overshadowed the positive economic aspects of the technology such as;

IMPROVED PRODUCTIVITY:

Since most UV curing applications require less than five second of UV exposure, the productivity gains can range from 40 to 300 %.

SUPERIOR QUALITY:

UV cured coatings have superior performance properties over conventional thermal cured coating's.

ENVIRONMENTAL FRIENDLY:

UV coating formulations , also called 100% solid, are typically VOC and HAP's free allowing for EPA permit exceptions in some districts. Overspray coatings can be collected and re-used providing a 90 to 95% coating transfer efficiency.

LOW ENERGY REQUIREMENT:

UV curing only consumes 20% of the energy needed for conventional coating systems.

FLOOR SPACE SAVING:

UV curing lines use approximately 60% less of floor space then conventional thermal systems.

LOWER CAPITAL COST:

UV coating systems normally require a lower capital cost investment versus conventional thermal coating systems.

RETURN ON INVESTMENT:

Faster, Smaller, Better & Cleaner = $ $ $ Dollars

WHAT IS UV CURING ?

Also called "photopolymerization " the Ultraviolet (UV) curing process is a photochemical reaction. Specially formulated inks, coatings and adhesives in combination with a small percentage of material called photoinitiator, are exposed to a spectral range of ultraviolet light. Nearly instantly they harden by crosslinking the liquid constituents.

MYTH ABOUT UV

Myth One
UV/EB Materials are Dangerous

Overall, UV/EB materials are much less toxic than solvent-borne and some waterborne coatings. UV/EB coatings exhibit the following properties:

- have a very high or no flash point;
- emit little to no VOCs;
- have very low systemic toxicity;
- are mostly not mutagens;
- are not, as a class, carcinogens
- are not fetal or reproductive toxins;
- are not regulated as hazardous waste; and
- don't appear on any Community Right to Know list.
- UV/EB curing materials are not absorbed through the skin as solvents are. Plus, they have very low vapor pressures, making inhalation less likely.

Myth Two
UV Light Used in UV Curing is a Significant Hazard

The biological effects of exposure to UV light resemble the typical symptoms of sunburn. We are all familiar with sunburn, so anyone who might be inadvertently exposed to excessive UV light would be quickly aware of it. The American Council of Government and Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) have established exposure limits for UV light that are easily met with shielding to minimize escape of UV light into the workplace.

Myth Three
UV/EB Preparations are More Expensive than Conventional Coatings

A quick comparison of the cost per gallon is usually the reason that energy-cured 100% solids materials are considered higher cost. However, a more realistic approach is to look at actual applied cost per dry mil (or per item coated).

For example, let's assume that we are using a roll coating application, the transfer efficiency is the same and 1,604 ft2/gal per mil will be applied for both a UV and thermoplastic coating. For the thermoplastic coating the total solids by volume is 32.62% and the cost per gallon is $13.67. For the UV coating the total solids by volume is 99.69% and the cost per gallon is $35. Therefore the applied cost of the thermoplastic coating is $0.0262/ft2 per dry mil compared to $0.0218/ft2 per dry mil for the UV coating. This adds up to an approximate savings of 17% by using the UV coating.

Myth Four
UV Finishes are Prone to Cracking and Yellowing

While this may have been true several years ago, the rapid growth and advancement of the industry (with many chemical companies offering new raw material products) and resulting advances in UV/EB chemistry have given the formulator a number of chemical classes from which to choose. With this flexibility, the industry is now able to easily meet customer requirements and develop products that best fit customer applications, including requirements for non-yellowing and resistance to cracking. In fact, on certain poor weathering substrates like extruded vinyl, UV clearcoats are used to prevent premature yellowing as well as improve stain and abrasion resistance. In another example, the headlights on your car have a UV coating to prevent scratches, cracks and yellowing.

Myth Five
UV/EB Equipment is too Expensive

During the last few years, the prices of capital equipment have come down considerably. In addition, when considering capital equipment costs, one must also look at the space required and the energy consumed by the equipment.

Space. A drying oven for a conventional thermal cure system may extend for 50-100 ft, resulting in a footprint of 500-1,000 ft2. At a floor space cost of only $0.50/ft2 per month, that costs $3,000-6,000 per year. The equivalent UV "oven" would require significantly less space (50-100 ft2) at dramatically reduced costs.

Energy Consumption. One of the most significant cost factors when comparing thermal curing to UV curing is the energy cost. A large gas curing oven consumes 1.10 MBtu/hr (and requires large blowers), while the same production capacity can be achieved with a UV dryer requiring only 82 kW total.

There are other considerations regarding UV/EB technology as well. UV/EB users enjoy an increase in uptime and productivity due to the nature of the chemistry (doesn't skin over in applicator, no need to clean up between shifts/weekends and faster startups). Increased productivity means more profits, which quickly pay for any initial capital equipment costs.

Other areas of cost savings come from a reduced number of parts in the process and a shorter processing time, which directly relates to lower inventories. Quicker cure allows for fewer particles to contaminate the surface finish, which directly relates to reduced rework and scrap costs.

SUMMARY

The question now becomes why are we not using more technologies that are protecting our environment. In the energy sector, renewable resources and nuclear; in the transportation sector, hydrogen; and in the finishing sector, UV technology.

There is no doubt in my mind, that all nations have to participate irrelevant of status.

Well I like the quote of Confusius which says it all:

"The superior man seeks what is right; the inferior one, what is profitable."

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