Cork Tech TalkNews

Manufacturers of Waterbase, UV+EB Curable Coatings, Varnishes and Adhesives

04/03

UV - MEASUREMENT & MAINTENANCE

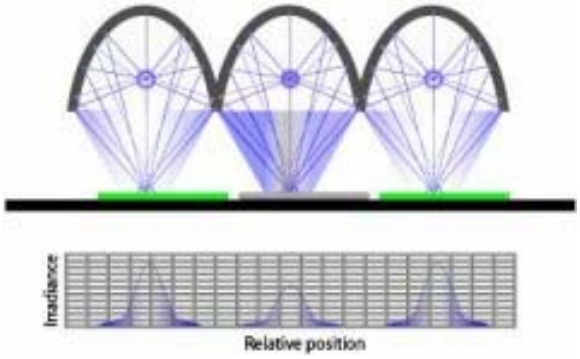
When curing UV inks, coatings, varnishes and adhesives it is critical to achieving cured property performance that the curable materials are exposed to adequate UV energy.

What is adequate UV energy? Essentially it comes down to having UV light present in the proper wavelength and intensity to effectively cure a particular formulation. Numerous UV curable raw materials are available for use in formulating inks, coatings, varnishes and adhesives. These materials, monomers, oligomers and photoinitiators vary not only in their responsiveness to a given wavelength of UV light but also in their relative reactivity.

Ideally when UV curing, one wants to know what total UV exposure is required, the most responsive wavelength, and intensity (or irradiance) required for effective penetration.

Total UV exposure (Joules/cm2) and irradiation (Watts/cm2) can be measured and monitored using radiometric tools. These tools, and others, offering a range of capabil-ity are available from a number of suppliers.

Considering radio-meters, several are available that allow passage thru a curing zone. Measurements can be made in a specific spectral (nm) region, and total UV exposure can be measured in millijoules/cm2. UV curing uses four spectral ranges which need to be considered depending upon the chemistry being cured. These are: UV-A (320-390 nm), UV-B (280-320 nm), UV-C (250-260 nm), and UV-V (390-445 nm). Radiometer probes can be changed to accommodate these different bandwidths. Use of a profiling radiometer can indicate if lamps are performing to specification. The shape of the profile provided can indicate that a given lamp is out of focus, has a dirty reflector, a misaligned reflector, is in focus but lamp output is weak, or is in fact a lamp with good output and is well focused.



Other hand held probe type radiometers are also available.

The newest technology, offered in spectroradio-meters offers the ability to measure across the entire UV spectrum 230-470 nm. For example, accurate profiles of each lamp in a multi-lamp system can be obtained in a graphical representation of each lamp in relation to a baseline. Baseline readings with a fresh lamp, clean reflector, and an up to par power supply are necessary for subsequent performance comparisons. Total dose, maximum irradiance and exposure time can be assessed. Data obtained can be downloaded to a PC for dose and spectral intensity analysis. Predictions of when a lamp is ready to fail can be made.

Relative intensity monitoring is another measurement technique that uses a sensor set at 100% when a new lamp is installed. The sensor continuously monitors intensity as the lamps output decreases. Generally it is recommended that a bulb be replaced when 60% of original intensity is reached.

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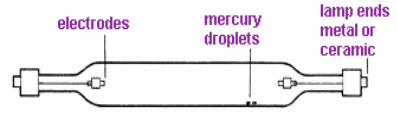
On the low cost side, there are adhesive backed "UV intensity tapes or labels". These can be adhered to product or substrate for passage thru a UV curing zone, resulting in a color change that is in direct relationship to the UV energy exposure. Color analysis establishes a reference. Other color change tape indicators are available that respond to spectral lamp output (wavelength), and do not measure actual intensity. Yet another tape system incorporates a UV/EB sensitive compound, which is destroyed when exposed to UV/EB energy. Dosimeter evaluation of the optical density resulting from exposure gauges the energy the tape has seen.

Meaningful measurements can also come from post UV cure testing. Off-line Q.C. testing of UV cured inks, coatings, varnishes and adhesives should be routine. Surface-cure burnish/rub, adhesion tape peel, and through-cure solvent rub testing should be conducted to assure that the expected product performance is achieved.

Maintenance is key to trouble free UV curing. Central to any UV curing system is the UV lamp or bulb. If the UV lamp is not outputting as specified then curing will not occur as expected. A comparison might be made to an unheated oven where no baking or drying will take place, or a burned out incandescent light that can no longer produce light.

Correct maintenance and handling of a UV lamp can increase lamp life as well as give assurance that the lamp will be outputting at its highest intensity.



Weekly inspection of UV lamps should be scheduled. Inspectors should look for:

- Debris fused into the quartz envelope
- Bowing of the lamp length
- Blackening of the lamp ends
- Whitening of the lamp ends
- Warping of the lamp ends
- Swelling of the lamp ends

Swelling, warping, or whitening that occurs can indicate that the system and lamps are not being cooled effectively. Adjustments in the air or water-cooling system are required. Lamps and reflectors need to be handled properly. Lamps should never be handled so that bare hands come in contact with the quartz envelop. They should be handled only by the ceramic ends or when wearing lint free gloves. Natural skin oil, when imprinted onto the quartz, will transfer and burn into the quartz causing UV light blocking opacity when the lamp becomes hot. Avoid this situation by cleaning the length of the quartz cylinder with an alcohol based cleaner before lamp installation. If quartz plates are used in the curing unit, maintain them so that they optimally transmit curing zone UV energy.

Clean, properly focused reflectors are another key to a UV curing system running with optimum design efficiency. Reflectors are responsible for focusing as much as 75% of the UV curing light reaching the curable material. It is critical that reflectors at all times be clean, free of dust and debris, with the original mirror finish preserved. You can readily see what a compromise it is if the lamp is outputting to spectral and intensity specs, but the reflector is not placing the energy effectively in the curing zone. Keep reflectors clean and replace them when the mirror finish starts to dull. Ensure that the reflector is not dented or misshapen effecting focus and see that alignment is perfect.

Regularly inspect and clean the UV lamp housing itself. Inspect light shielding to ensure no undo leakage. Clean all intake air filters removing dirt, dust and debris build-up so that optimum air-cooling is maintained.

Inspect the shutter mechanism for proper functionality, and the power supply to ensure proper optimum specified operation.

Perform time saving maintenance at least once a week, log findings, and you'll be on your way to consistent, trouble free UV curing.

LOOK TO CORK! ..... for all of your aqueous, UV & EB coating, varnish and adhesive needs.

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