JOULES
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U.V. PRINTING INKS CORP.

OPTIMIZING UV CURING ON PRESS

When inks or coatings fail quality control tests due to undercuring, what can be done to remedy the situation? First, talk to us to make sure the ink you are using for the application is right for the job. Then take a close look at your lamp setup to ensure it is functioning as efficiently and effectively as possible.

Remember that UV lamps do not last indefinitely. The average life span of most bulbs is considered to be 1000 hours. However, from the moment you first fire up that bulb, its UV output is gradually reduced. The fact that it is producing light is not a determinant in whether it can cure properly, because light that you can see with your eyes is visible light. The UV range of wavelengths that is required to cure UV inks and coatings, however - is invisible to our eyes. This also explains why you should never look directly at the light from a UV bulb – the wavelengths that will injure your eyes are not readily seen. Always ensure that all light shielding is properly attached to avoid exposure of the skin and eyes to UV radiation.

The reason that UV output decreases gradually over time is because it is generated by vaporizing mercury inside the lamp. Prior to starting the lamp, the mercury inside is in the form of a liquid. Once the bulb is energized, the mercury vaporizes to a gas, and begins to emit light in the UV and visible ranges. After the system is shut down, the mercury reverts to its liquid state inside the bulb. This is not a perfect process, as the repeated starts and stops begin to cause some of the mercury to deposit inside the glass near the ends of the bulb. This mercury is then incapable of being vaporized at the next startup. As a result, each time the bulb is powered up, there is just a little bit less mercury that is activated to produce light. This is why the more starts and stops you have, the quicker the life of the bulb is shortened.

Dopants (additional metals added to the mercury inside the bulb to increase intensities in some parts of the UV spectrum) can have a greater tendency than mercury to deposit out near the electrodes on the bulb envelope. So a doped bulb (V – gallium doped, D – iron doped), will revert back to a mere mercury bulb over an abbreviated period. The reason this happens is that these metals are harder to excite and keep in the vapor state than mercury – so they are more likely to break down and experience deposition over the life span of the bulb. This is also why lamps with dopants are harder to start, and explains why the power supplies needed to illuminate doped bulbs are different (higher voltage) from those used to

start the conventional H (mercury) bulb. A modification in the cooling system may also be needed to run doped bulbs. Doped lamps are also called “additive” lamps.

When looking for metal deposition in a lamp, you can see it at the ends of a bulb – it will appear as a darkening near the electrodes. In addition to this, other causes of a drop-off in lamp output are cloudiness of the lamp tube itself, and degradation of the lamp electrodes. Make sure to examine the lamps at 500 hours of operation and thereafter every 250 hours to determine whether the lamps have clouded or darkened, and whether deterioration of the electrode has occurred. Note that under- or overcooling of the lamp can hasten the occurrence of all of these causes of reduced lamp output.

Regarding cooling, maintenance of the cooling apparatus is essential. Both water and air cooling are used to keep the lamp housings and reflectors cool. It is important not to overheat the reflectors, as they will darken or distort, and this will mitigate their ability to reflect UV light onto the printed surface.

In a water cooled system, make sure the chillers always have proper water levels, and that the water is treated to avoid corrosion. Supply hoses should be kink-free. For air cooled systems, make sure the openings in the lamp housings (that provide guidance for the air) are clear of debris. Some common debris that can cause a problem are: spray powder, paper dust, and paper scraps. Also make sure that the openings of any blowers used for supply or exhaust air are clear as well, and that the hoses for same are free of obstructions and kinks.

Make sure the reflectors and lamps are clean. If there is dust or dirt on their surfaces, then they are absorbing UV light, not reflecting/transmitting it. This will diminish what is being supplied to the printed surface. The reflectors should be inspected and cleaned every 500 hours or sooner if a noticeable falloff in cure is noted. Cleaning reflectors and lamps is best done with isopropyl alcohol, and a soft, lint free cloth. Do not use abrasive materials, and do not touch either the reflector or the lamp with your bare hands. Oils from your skin can cause premature failure of the lamp and can irreversibly stain the reflectors.

Whenever possible, measure the output of your lamp system with a probe or other device suited for use with your specific system. Measuring bulb output is the best way to recognize that you are getting consistent UV dosage. In our lab, we “map” the UV bulb output in the four UV ranges (V, A, B, and C) periodically - to note whether falloff occurs across the board or preferentially in one or more of the UV ranges of the spectrum. For reference, UVV range is 400 nm and over; UVA is 320 – 400 nm; UVB is 280 – 320 nm, and UVC is 200 – 280 nm. The shorter wavelengths of light (UVC) are more proficient at surface curing; the longer wavelength ranges (UVA) are more prominent in through-curing of inks and coatings.

Contact us if you have further questions about curing – we are here to help!