

## UV LAMPS: SOME FACTS

As ultraviolet (UV) curing has grown, the number of equipment manufacturers has also multiplied. With this has also come some problems since different equipment can have significantly different curing effects. The purpose of this short discussion is to shed some light onto these differences.

The basic types of UV producing lamps can be categorized as: 1, medium pressure mercury (MPM) lamps; 2, pulsed xenon lamps; and 3, germicidal lamps.

Of most importance to the UV curing industry is the first type so the remaining discussion will deal only with medium pressure lamps. If information on the other light sources is desired, please contact your nearest **SunChemical** branch.

The basic MPM lamp is a tubular quartz electrode lamp which has mercury vapor inside. The excited mercury gas emits energy which includes UV, visible light and infrared heat energy. The mercury is responsible for the light/energy spectrum. This can be altered to varying degrees with trace quantities of other elements. These modified lamps are called doped lamps. The photoinitiators in inks and coatings respond to specific spectra energies so the lamps spectra is critical to curing. Most UV curing products are designed to work with the general purpose standard lamp. In some cases better results can be obtained with doped lamps but extreme care must be taken not to end up moving in the wrong direction. Any testing in this area needs close

cooperation with end user, material suppliers and equipment suppliers.

One manufacturer supplies electrodeless lamps which offer greater variation in doping.

These lamps are excited by high power microwave radiation. Because of this, the lamps are quicker to come to full power and restart after a shutdown. The 10 inch modular units also lend themselves to narrow applications.

UV lamps normally operate at 700 to 800 degree C. Because of this, the curing unit must be cooled. This is normally accomplished with air and water. The UV energy reacting with oxygen creates ozone. This must be exhausted out of the area. To minimize ozone production, lamps are available which use modified or doped quartz.

These "ozone free" lamps modify the spectral output by cutting off the far UV. Although the ozone is minimized with these lamps, the cure speed can significantly deteriorate due to the altered UV spectrum.

Some lamp manufacturers have also developed water cooled lamps which use a water jacket around the lamp bulb or between the bulb and the substrate to absorb and carry away the infrared energy given off by the UV lamp. Unfortunately, unless the water is ultra pure, the water also absorbs UV energy and reduces the cure of the inks

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and coatings. Any impurities in the water will also slowly coat the inside of the jacket and further reduce curing efficiency.

During operation, it is highly unlikely that the lamps will be contaminated. The high temperature of the lamp surface causes organic materials to decompose. It is possible for inorganic materials (such as cement dust) to destroy lamps by settling on the quartz tube, fusing with it and opacifying it. Organic materials (such as dusts, oils, greases and ink) will destroy the lamps if they are on the surface during start up.

Lamp output will deteriorate with time. Most standard lamps come with a 1,000 hour warranty. The electrodeless lamps have a 3,000 hour warranty. Lifetime beyond the warranty times are certainly possible with proper care and maintenance. Just because the lamp is bright, the voltage is correct and the 1,000 hours has not been obtained, this does not mean the lamps are operating at peak UV efficiency. Just as with "doped" quartz, the loss of only part of the UV spectrum can have serious effects on curing capabilities.

The majority of lamp systems use focused reflectors. These reflectors must also be clean in order to be effective. Since the focused design is meant to place as much energy in a small target area as possible, it is important that the substrate to be cured is in this target area as it passes in front of the lamp. Cure rates will suffer if these parameters are not met.

*For further information regarding energy curing, contact your local **SunChemical** branch.*