

SLM Resolves End User Complaints about Traditional Arc Lamps

By Bonnie Larson

The science behind creating UV curable materials has grown to be more than a billion dollar industry enabling new applications for curing across many different markets. UV curing is a technology that offers its users both savings in time and money as well as relief from increasingly restrictive environmental regulations. As materials have progressed, so too must UV light source technology. Creating UV light with the desired properties has evolved with recent significant improvements showing there is a new light on the horizon. Phoseon's Semiconductor Light Matrix (SLM) Technology has proven that there is a solution to the problems users of UV light sources have expressed:

- **Operating Cost:** Ever increasing energy costs have focused attention on not only electrical efficiency but also overall operating costs.
- **Productivity:** Frequent bulb replacement is disruptive to manufacturing decreasing productivity.
- **Yield:** Reliability associated with drop in UV output over time causes yield issues.
- **Heat:** Excessive heat distorts parts.
- **Regulatory Compliance:** Increasing regulatory constraints on the industry have caused end users to be more aware of what new technologies are being integrated into their production lines.

Operating Cost: The savings realized from using SLM technology cover not only reduced down time, but actual operating costs as well.

Electricity prices for industrial uses in the US have more than tripled over the last 20 years. Therefore, end users are paying closer attention to electrical requirements of their production equipment. Electrical consumption (kWhr) is up to seven times less when using SLM Technology versus traditional arc lamps.

Traditional arc lamps operate at very high temperature (850-950°C) requiring air extraction and an additional burden on the factory HVAC system. When using SLM technology which operates at 60°C, there is no requirement for air extraction.

Traditional arc lamps create light from mercury vapor, and discarded lamps cannot simply be thrown away. Therefore, there is a cost associated with waste removal.

Labor costs associated with lamp replacement and maintenance is virtually eliminated when using SLM Technology.

Using traditional arc lamp technology as the baseline at a factor of 1, the chart shown in Figure 1 compares the relative operating costs to SLM Technology:

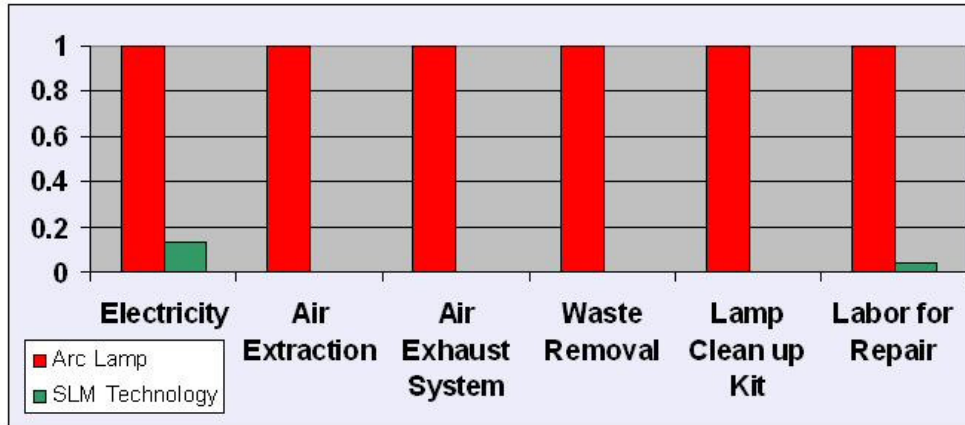


Figure 1. Comparison of Operating Cost between Arc Lamp and SLM Technology

Productivity: When the curing process stops working due to insufficient UV output, the output is typically replenished by replacing the UV source. The UV source replacement frequency as well as general maintenance will impact productivity.

UV Source Expected Lifetime:

Arc Lamp	SLM Technology
500-1000hrs*	>10,000hrs

**Arc Lamps will continue to generate output, but when the output drops below the process window for a given application the lamp must be replaced.*

Replacement of UV lamps involves the time it takes to physically change the bulb, in addition to cool down and warm up time. Many arc lamps also use special reflectors to filter unwanted wavelengths of light. These reflectors must be inspected, cleaned and replaced when necessary which can take up to five hours quarterly.

Since SLM technology has a significantly longer lifetime, downtime associated with changing UV sources is reduced from up to once a month to once a year or less. The improvement in system uptime associated with UV light source replacement alone is reported to be from 97% with arc lamps to greater than 99% when using SLM Technology.

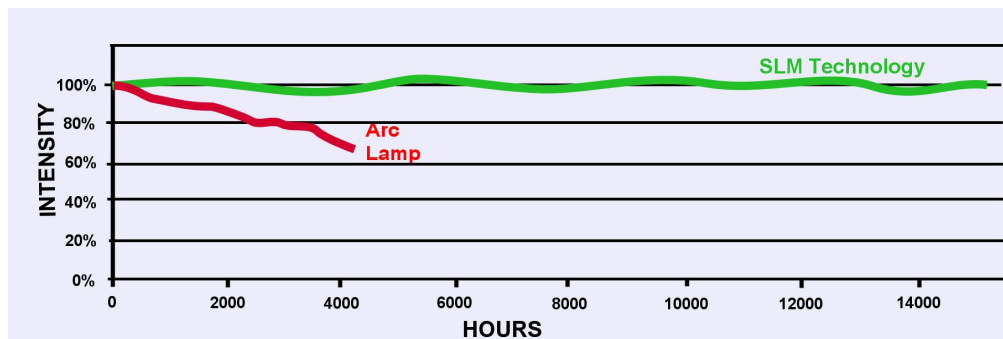


Figure 2. Comparison of Lifetime between Arc Lamp and SLM Technology

Yield: SLM Technology makes monitoring UV light source operating parameters easier to ensure higher yield. Since SLM technology does not drop over time like arc lamps, the process is more reliable, reducing not only down time but increasing yield (Figure 2).

Feedback from end users that have replaced arc lamps with SLM technology indicates that yield improvements have gone from 95% to 99%. This is particularly true for UV curing of pressure sensitive adhesives, where too much or not enough UV dose will require that the product be scrapped.

Heat: Many applications are sensitive to heat, e.g., printing onto plastics or styrene. Since SLM technology operates at less than 60°C while lamps operate at more than a factor of 10 higher temperatures, the risk associated with excess heat is correspondingly less.

Regulatory Compliance: The need for restricting the use of hazardous substances and solvents is becoming more and more of a deciding factor for moving to UV cured materials to address restrictions on solvents. However, there are also considerations related to the UV light source itself. Traditional arc lamps use an electric discharge from mercury vapor to produce light. At the moment, arc lamps are exempt from the Reduction of Hazardous Substances (RoHS) directive, but there are concerns related to having such a toxic substance in the workplace.

Traditional arc lamps emit light over the full spectral range. When oxygen molecules (O_2) are exposed to light in the 180-220nm wavelength range, they split into (O) atoms and recombine with oxygen molecules (O_2) to form triatomic oxygen (O_3) or ozone. Ozone is a hazardous material which must be extracted. Conversely, SLM technology produces only the targeted UV light which does not produce ozone (Figure 3).

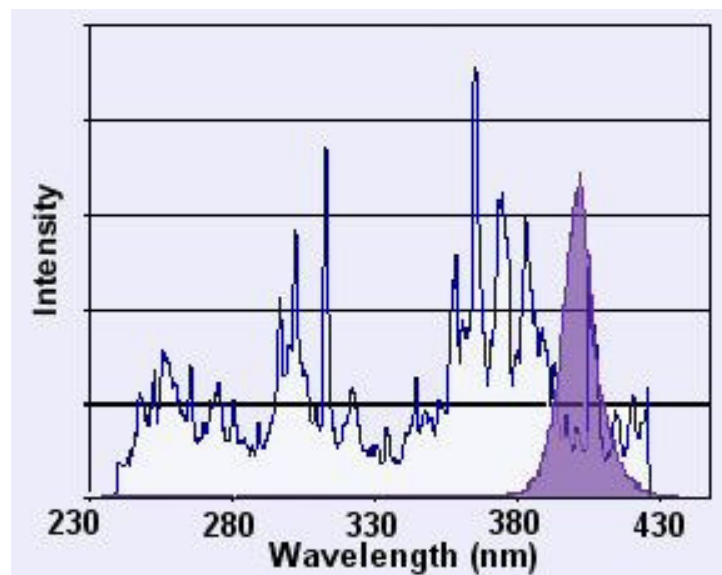


Figure 3. Comparison of Output Intensity and Wavelength between Arc Lamp and SLM Technology

Conclusion: SLM technology works to solve many of the problems resulting from traditional arc lamps, and to simplify the UV curing process. SLM technology is available to answer the call for a better UV light source.