

Dymax UV Light-Curing System Safety Considerations

Dymax ultraviolet light-curing technology has been used successfully for over 30 years. The fast-cure, one-component nature of our UV light-curing technology has made it the process of choice for many manufacturers requiring a "cure on demand" assembly process. The purpose of this document is to provide information relating to the use of Dymax UV light-curing systems. There are four common questions/concerns related to UV light-curing systems: UV exposure, high-temperature surfaces, ozone, and bright, visible light.

UV EXPOSURE

Standard Dymax UV light-curing systems and bulbs have been designed to primarily emit UVA light³ (as shown in Chart 1). UVA light is generally considered the safest of the three UV ranges: UVA, UVB, and UVC. Although OSHA does not currently regulate ultraviolet light exposure in the workplace, the American Conference of Governmental Industrial Hygienists (ACGIH) does recommend Threshold Limit Values (TLVs) for ultraviolet light. The strictest interpretation of the TLV (over the UVA range) for workers' eyes and skin is 1 mW/cm² (intensity), continuous exposure. Unless workers are placing bare hands into the curing area, it is unusual to exceed these limits. To put 1 mW/cm² limit into perspective, cloudless summer days in Connecticut regularly exceed 3 mW/cm² of UVA light and also include the more dangerous UVB light (primarily responsible for sun tans, sun burns, and skin cancer) as well.

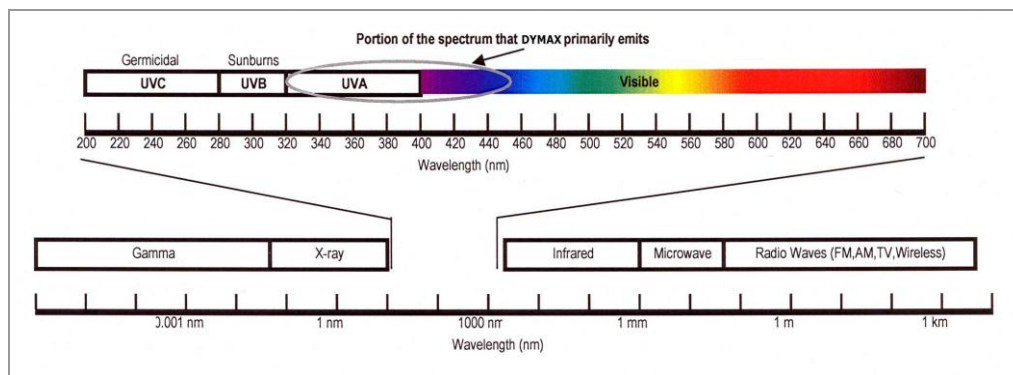


Chart 1. Electromagnetic Spectrum

The human eye cannot detect "pure" UV light, only visible light. A radiometer should be used to measure stray UV light to confirm the safety of a UV light-curing process. A work station that exposes an operator to more than 1 mW/cm² of UVA continuously should be redesigned.

UV adhesive curing can be a regulatory compliant, "worker-friendly" manufacturing process when the proper safety equipment and operator training is utilized. There are two ways to protect operators from UV exposure: shield the operator and/or shield the source.

SHIELD THE OPERATOR

- **UV-Blocking Eye Protection** – UV-blocking eye protection is recommended when operating UV light-curing systems. Both clear and tinted UV-blocking eye protection is available from Dymax (see Table 1).
- **UV-Blocking Skin Protection** – Where the potential exists for UV exposure upon skin, opaque, UV-blocking clothing, gloves, and full-face shields are recommended.

SHIELD THE SOURCE OF UV

Any substrate that blocks UV light can be used as a shield to protect workers from stray UV light. The following materials can be used to create simple shielding structures or blind corners:

- **Sheet Metal** – Aluminum, steel, stainless steel, etc. Sheet metal should be coated black or black anodized to minimize reflection of UV and visible light toward operators.

- **Rigid Plastic Film** – Transparent, UV-blocking plastics (typically polycarbonate or acrylic) are commonly used to create shielding where transparency is also desired. These rigid plastic films are available either water-clear or tinted.
- **Flexible Film** – UV-blocking, flexible urethane films can be used to quickly create workstation shielding. This UV-blocking, flexible urethane film is available from Dymax (see Table 1).

HIGH-TEMPERATURE SURFACES

Surfaces exposed to high-intensity curing lights will rise in temperature. The intensity, distance, exposure time, cooling fans, and the type/color of the surface can all affect the actual surface temperature. In some cases, exposed surfaces can reach temperatures capable of producing a burn or causing damage to a substrate. In these cases, care must be taken to ensure either a more moderate surface temperature or appropriate protection/training for operators.

OZONE

Standard Dymax bulbs (UVA type) generate an insignificant amount of UVC and therefore essentially no ozone³. Some UV curing systems, like those used to cure UV inks, emit primarily “shortwave” (UVB and UVC) energy. Upon exposure to UVC light (specifically <240 nm), oxygen molecules (O₂) split into oxygen atoms (O) and recombine with O₂ to create ozone O₃. The current, long-term ozone concentration limit recommended by ACGIH, NIOSH, and OSHA is 0.1 ppm (0.2mg/m³).

BRIGHT, VISIBLE LIGHT

The bright, visible light emitted by some UV light-curing systems can be objectionable to some workers and can cause eyestrain. Tinted eye protection and/or opaque/tinted shielding can be utilized to address this concern.

SUMMARY

UV light sources can be more “worker friendly” than many commonly accepted industrial processes, provided the potential concerns are addressed. Contact your Dymax representative for information regarding the proper use of Dymax UV light-curing systems.

Table 1. UV-Blocking Eye Protection and Shielding		
		
Clear ¹ ; No tint PN 35612	Green ¹ ; Medium tint PN 35614	
		
Clear “Over-the-Glasses” ¹ ; No tint; for use over eye glasses PN 35284	Grey “Over-the-Glasses” ¹ ; Medium tint; for use over eye glasses PN 35285	
		Flexible Urethane Shielding 8” wide, per linear foot PN 35531
Dark Green ¹ ; Maximum tint PN 38349	Dark Green “Over-the-Glasses” ¹ ; Maximum tint; for use with eye glasses PN 35286	

¹ Per manufacturer, 99.9+% UV blocking and meet ANSI Z87.1 and CSA Z94.3 requirements

² Meets ANSI Z87.1

³ Dymax also provides special order “shortwave” bulbs that emit primarily UVB and UVC light. Contact Dymax directly for information regarding the use of “shortwave” bulbs.



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