Key Benefits of Next-Gen UV LED Technology

by Richard Halliday, Director of Distribution Products, Lumex

Creating LED and LCD Solutions Together™

Key Benefits of Next-Gen UV LED Technology

by Richard Halliday, Director of Distribution Products, Lumex

Despite the potential hazards of ultraviolet light which are evident in everyday life, such as sunburn, the UV spectrum is proving to have many beneficial effects in a multitude of areas. Not unlike how standard, visible LEDs have impacted today's marketplace, the advancement of UV LEDs is offering a wide range of advantages to a diverse number of applications.

Recent technological advancements are moving the UV LED market segment into a whole new level of product innovation and performance. Design
engineers are taking note as emerging UV LED technologies generate significant cost, energy, and space savings compared to alternate technologies.

Five key benefits of the latest generation of UV LED technology demonstrate why the market is projected to grow 31% in the next five years.

Wide Range of Applications

The UV spectrum encompasses all wavelengths between 100nm and 400nm in length and is commonly broken down into three distinct subfields:

- UV-A: 315-400 nanometers (also known as long wave UV),
- UV-B: 280-315 nanometers (also known as medium wave UV), and
- UV-C: 100-280 nanometers (also known as short wave UV).

Figure 2. UV LED technology is well suited for a wide variety of medical device applications including teeth brightening and cavity filling technologies (UV-A) and toothbrush and medical instrument sterilization equipment (UV-C).

Dental curing instruments and counterfeit detection applications were early adopters of UV LED technology- but performance, cost and durability benefits combined with recent enhancements in life span are causing UV LEDs to be integrated into a rapidly growing number of applications.

Today, UV LED applications include:

230-400nm: optical sensors and instrumentation
230-280nm: UV ID verification, barcodes
240-280nm: sterilization of surface areas and water
250-405nm: forensic and bodily fluid detection and analysis
270-300nm: protein analysis, drug discovery
300-320nm: medical light therapy
300-365nm: polymer and ink printing
375-395nm: counterfeit detection
390-410nm: superficial/cosmetic sterilization

Environmental Impact - Lower Energy Consumption, Reduced Waste and No Hazardous Materials

UV LEDs provide several significant environmental benefits compared to alternative technologies. UV LEDs have up to 70% lower energy consumption compared to compact florescent (CCFL) lamps. Additionally, UV LEDs are RoHS compliant and do not contain the toxic mercury often found in CCFL technology.

UV LEDs are also much smaller in size and more durable than CCFLs. UV LEDs are more resistant to vibration and impact, resulting in less product breakage and reduced waste and maintenance expense.

Enhanced Life Span

Over the last ten years, UV LED technology has been challenged by insufficient life spans. Despite their many benefits, adoption of UV LED technology was significantly slowed due to the fact that UV rays easily broke down the LED epoxy, degrading the life span of UV LEDs to less than 5,000 hours.

The next generation of UV LED technology featured “hardened” or “UV resistant” epoxy packages that provided life spans of up to 10,000 life hours, still not nearly enough for most applications. This still insufficient life span was further complicated by the fact that epoxy break down is erratic and not graceful or linear, resulting in poor performance even before the life span was completely exhausted.

In the last several months, new technology has emerged that has solved this engineering challenge. For example, in Lumex´s new QuasarBrite UV LED technology, the epoxy lenses were replaced with a robust TO-46 package with glass lens allowing the technology to last at least ten times longer, providing a life span of more than 50,000 hours.

With this major engineering challenge resolved along with issues related to die stabilization at specific wavelengths, UV LED technology has become an attractive option for a growing number of applications.

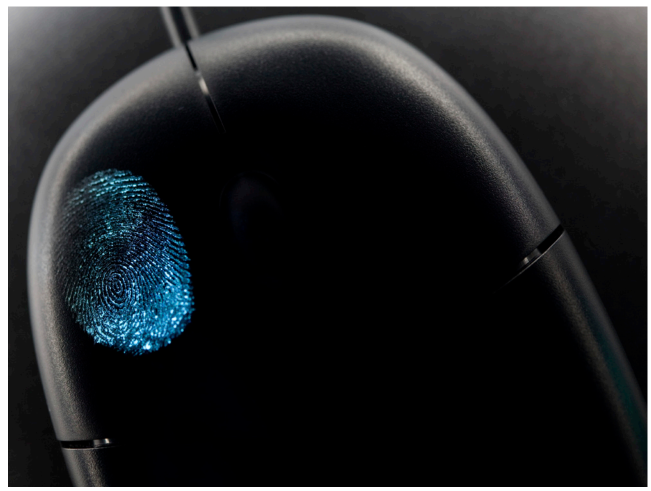

Figure 3. UV LED technology has several forensic applications including fingerprinting and bodily fluid detection and analysis.

The next major challenge for UV LED technology will come in the area of efficiency. For many applications such as medical light therapy, water sterilization and polymer curing at less than 365nm, the output power of UV LEDs is only five to eight percent of input power. At 385nm and above the efficiency improves, but only to about 15 percent. As emerging technology addresses these efficiency challenges even more applications will begin to adopt UV LEDs.

Performance

UV LEDs also provide significant performance benefits compared to alternative technologies. UV LEDs can provide tight beam angle and uniform beam patterns. Because of the challenges in optical efficiency inherent to UV LEDs, most design engineers are looking for a specific beam angle that maximizes the output over the targeted area. With ordinary UV lamps, the engineer has to rely on flooding the area with enough light to try and achieve the right combination of uniformity and intensity. With UV LEDs, the lensing allows for a much tighter emission angle, allowing the majority of the UV LEDs output to be focused directly where it is required.

To match this performance, alternate technologies would require secondary lenses with additional cost and space requirements.

The combination of tight beam angle and uniform beam patterns without the need for a secondary lens, reduced energy consumption and enhanced durability allows UV LEDs to provide up to 50% cost savings compared to CCFL technology.

Cost-Effective Application Specific Options

It is often far more practical from both a cost and performance perspective to create UV LED solutions specifically designed for a particular application than it is to adopt standard technology to specific applications. In many cases, UV LEDs are used in an array where beam pattern and optical intensity consistency are critical across the entire array. By having a UV LED supplier provide a full integrated array specifically for the application the overall BOM can be reduced, the number of suppliers can be reduced and the array can be tested for the specific application before it is released to the design engineer. This reduces cost in the engineering and procurement departments by reducing transactions, provides a highly efficient solution that is tailored to match the demands of the end application.

Be sure to look for a UV LED supplier who can provide cost-effective custom UV LED solutions specifically designed for your application needs. For example, a supplier partner who has decades of experience with PCB design, custom optics, ray tracing and molding will be able to offer a host of options for the most cost effective and targeted solution.

In conclusion, recent technical enhancements to UV LED technology have resolved issues with die stabilization and greatly expanded life span – up to 50,000 life hours. These developments combined with their enhanced durability, lack of hazardous materials, reduced energy consumption, compact size, quality performance, cost savings and cost-effective custom options, are making UV LEDs an attractive alternative for a rapidly growing list of markets, industries and applications.

In the months and years ahead further enhancements will be made - especially in the area of efficiency- causing UV LED adoption to grow even more rapidly.

Lumex QuasarBrite™ UV LEDs

385nm: SSL-LXTO46UV1C
405nm: SSL-LXTO46UV2C
415nm: SSL-LXTO46UV3C