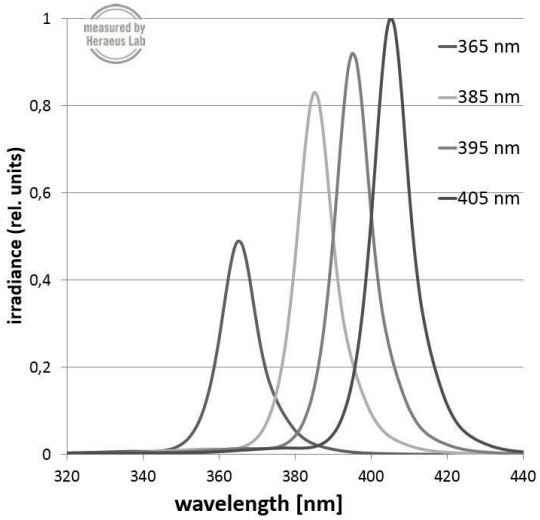
# 5 Ways UV LED Curing Improves Manufacturing Curing Processes

Commercial use of UV LED curing technology is advancing at a rapid pace due to improvements in energy output and increasing availability of ink, adhesive, and coating chemistry formulations. The intensity output of UV LEDs is increasing at a rate of 12% annually!

This means applications that require faster production speeds are now becoming feasible.

This article provides process design and development engineers with a brief introduction to UV LED curing, benefits for manufacturing production lines, and next steps to ensure you stay ahead of your competition.

## UV LED Output




Unlike traditional UV curing which has a broad spectrum output, the output of UV LEDs for curing is currently available in one of three narrow, nearly monochromatic, wavelengths – 365, 385, 395 and 405 nm.

While this means less wasted output (unneeded or unusable wavelengths), it also means chemistry formulators needed to develop new chemistries responsive to these specific wavelengths while still delivering the specific ink, coating, or adhesive requirements. Some applications such as electronics encapsulating and potting, fiberglass composites, UV powder coating, spot cure and laminating adhesives already use longer wavelength additive, or “doped”, arc lamps. So these applications are a natural fit for using UV LED curing.

## Commercial UV LED curing

Currently, UV LED curing is being used commercially for graphic arts printing applications such as digital inkjet, flexographic, and offset sheet-fed printing as well as industrial inkjet marking/coding, adhesive bonding and assembly, sealing, screen print decorating, optical fiber coatings, wood decorating and coating, photoresist applications, and many others across industries such as automotive, medical devices, electronics, packaging, building materials, alternative energy, and many more. Retrofitting manufacturing production lines which have existing UV curing systems to UV LED curing systems (in addition to or as a replacement) is inevitable for certain applications given the significant process improvements and resulting bottom line business benefits available.

# Manufacturing process design and business benefits of UV LED curing

## 1. Increased production rates

Compared to existing UV curing technology UV LED curing systems offer more uptime due to their significantly longer life and instant on/off capability. UV LEDs operate up to 10 times longer (10,000+ hours) than arc UV curing systems.

The instant on/off capability of UV LEDs means no more waiting to restart a line or deal with maintenance prone shutters as is required with arc UV lamps. More uptime results in higher production rates.

## 2. Increased process flexibility and control

UV LED curing systems operate at much cooler temperatures than traditional UV curing making it **possible to process heat sensitive materials without damaging them**. Dimming controls mean you can dial in exactly the UV energy needed for changing process needs. In addition to less product waste, this increased process flexibility and control can **expand your production capabilities and deliver higher production line utilization**.

Assuming there is space on your line, adding UV LED to existing traditional UV curing can provide further flexibility and a production "test bed" before implementing on additional lines and plant locations.

## 3. Easy to retrofit - conveyors, indexing machines or robots

The smaller form factor of UV LED curing systems makes them easy to retrofit onto most existing manufacturing production lines such as flat or 3D conveyor lines, indexing machines, or on robotic arms. UV LEDs need cooling, but it's done using either internal muffin-type fans or water cooling.

There is no need for shutters, and heat management and light shielding is greatly simplified. Finally, since there is no ozone generated (traditional UV lamps generate ozone from their short-wave output around 180 nm to 220 nm) or mercury in UV LEDs, the working environment is safer.

## 4. Improved process reliability and global consistency

Today's process designers need reliable and consistent UV curing processes that they can easily duplicate, or even relocate, anywhere across the globe. UV LED systems

are significantly smaller and lighter, **so relocating them is simpler and less costly** than traditional UV curing.

And since UV LEDs need considerably less cooling/ exhaust air, production lines located at higher or lower elevations won't need significantly different cooling cfm. So **UV LED curing provides a more reliable and consistent process no matter where it is located across your global manufacturing sites.**

## 5. Reduced operating costs

UV LED curing offers significantly lower operating costs compared to traditional UV curing due to energy savings, fewer consumable parts, and lower maintenance costs. **UV LEDs typically use about 30 – 70% less energy** compared to traditional UV curing. Not having to keep consumable parts like lamps, ballasts, and reflectors on hand reduces costs.

Finally, lower maintenance results from less labor time spent replacing lamps and cleaning/servicing other parts such as ballasts, shutters, reflectors and fans.

## Challenges

In the same way that LED technology has replaced some automotive lighting, interior lighting, and other traditional light sources, UV LED curing will inevitably replace traditional UV curing technology for some ink, coating, and adhesive applications due to the advantages discussed here. Of course challenges remain for UV LED curing in some manufacturing processes including finding suitable and available chemistry formulations. Applications that require a hard coat are especially challenging for UV LED curing since short wavelengths, well below 365 nm, are needed for surface curing. Pairing UV LED curing with existing UV curing can be an ideal solution.

## Next steps

So what should manufacturing process development and design engineers do now to avoid being left behind?

First, **begin learning more about UV LED curing technology, equipment providers, and possible chemistry formulation partners** to understand if UV LED is a fit for your manufacturing processes.

Second, **build relationships with experienced providers** who can help you develop reliable and flexible UV LED curing processes via lab testing and in-plant trials. You'll need partners who can help you assess feasibility, ROI, and provide guidance and process development support.

Start learning more now by reading **How UV LED Curing Reduces Manufacturing Line Downtime** – The most interesting advantage of UV LED curing for process design and development engineers is the opportunity to reduce downtime compared to existing medium pressure arc lamp UV curing processes. This deep dive will help you gain a better understanding of the impact for your manufacturing process.

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