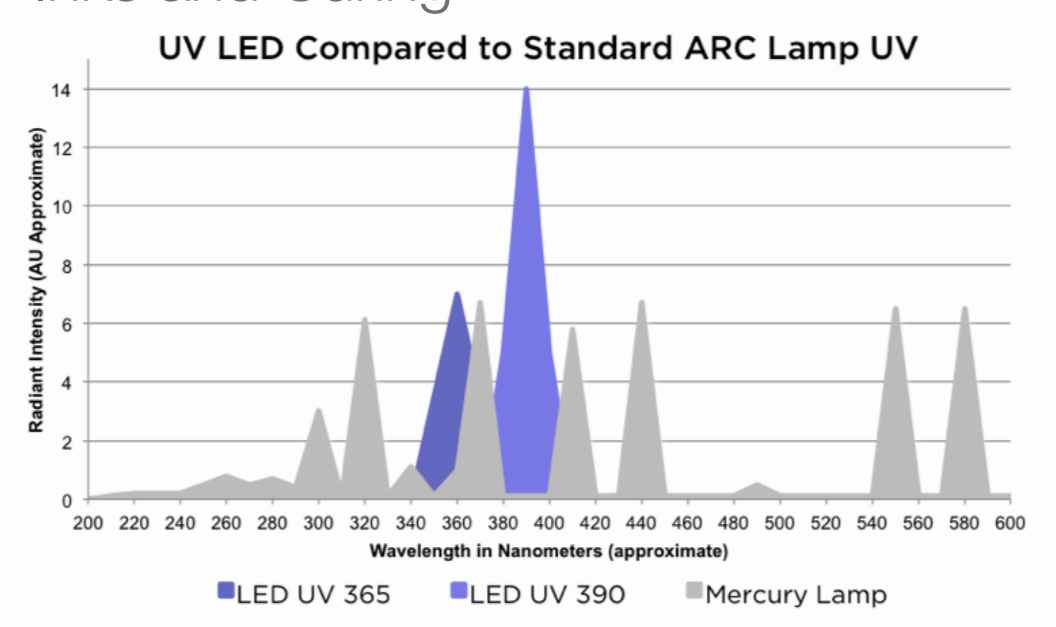
UV LED Inks and Curing



Source: http://www.airmotionsystems.com/peak-led-uv-systems/

Background

UV LED ink and curing systems have seen positive growth over the past couple of years due to advances in technology and the increasing demand for more environmentally friendly methods of curing, which at the moment are dominated by mercury lamps. The purpose of this bulletin is to look at the latest developments in UV LED inks and curing technology for narrow web converters.

UV LED Inks

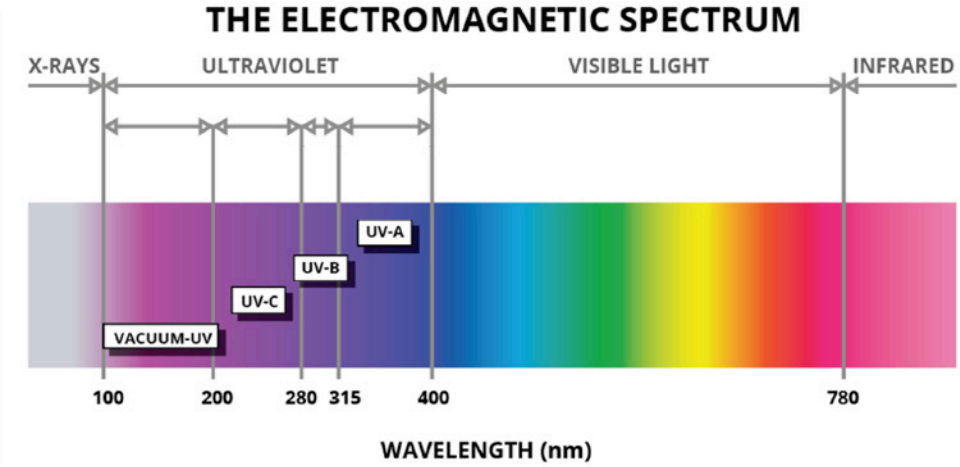
UV LED inks differ from traditional UV free radical inks in their formulation. Special consideration of photoinitiators and pigments in the formulation must be made to match the spectral output of the LED lamps. These special photoinitiators absorb at a higher wavelength as opposed to traditional photoinitiators and are typically more expensive. The spectral output of a LED lamp to cure UV LED inks is very narrow, 365 – 405 nm, as compared to a UV mercury system which operates from 200 – 700 nm range.

UV LED Curing

Because of the limited spectral wavelength, UV LED primarily operates in the UV-A zone and considered to be 'safe' because it is closest to visible light. However, prolonged exposure to this energy can be dangerous. The UV-B and much of the UV-C spectrums of light are primarily used for germicidal and sterilization purposes. Light produced at these wavelengths are not only harmful to microorganisms, but are also dangerous to humans and other forms of life that may come in contact with it.* These lamps should always be shielded and never viewable to the naked eye, even though it may appear that little or no light is emanating from the device. Exposure to these wavelengths may cause skin cancer and temporary or permanent vision loss or impairment.*

Applications

- **UV-A** type devices have been traditionally used in applications such as counterfeit detection or validation (currency, identification documents, etc). The actual wavelengths used are in the 390 nm – 420 nm range. As a result, these type of LED's are readily available from a variety of sources and are considered the least expensive.
- **The middle UV-A LED** area 350 nm – 390 nm are for curing both commercial and industrial materials such as adhesives, coatings and inks. There are many advantages over traditional curing technologies due to increased efficiencies and lower cost of ownership. Although the cost of this technology is greater, advances in manufacturing and demand are driving prices down.
- **The lower UV-A and upper UV-B** ranges 300 nm - 350 nm are the most recent introduction to the marketplace. These units can be used in a variety of applications including UV curing and biomedical applications. There is a significant overlap in all three of the UV spectrum ranges, so consideration must be made in what is best for the application.
- **The lower UV-B and upper UV-C** ranges 250 nm – 300 nm, is still in it's early development stage. However, there is a great interest in these LED's in air and water purification systems.



www.marktechopto.com/understanding-ultraviolet-LED-applications-and-precautions.cfm

Advantages of UV LED

- No IR radiation, less heat
- More compact than mercury systems
- Low voltage
- No shutters or glass quartz
- Consistent and immediate UV output over operating life
- No UVC and therefore no ozone emitted, eliminating need for exhaust
- Does not contain heavy metals (mercury)
- Longer life, + 20,000 hrs as compared to 1,500 hrs on a standard UV mercury lamp
- Easier to convert materials that are heat sensitive
- LEDs are more efficient than mercury bulbs

Disadvantages of UV LED

- More expensive technology
- Limited spectral output
- Higher ink cost because of special photoinitiator and formulation

In a recent UV LED trial at one of our customers, an LED lamp was positioned on one half of the 30" web, focused on curing through the liner for clear materials, as opposed to mounting the lamp and focusing the energy on the face material. The result was curing at speeds in excess of 800 ft/min. Press side testing was done by means of cross hatch and 610 tape.

Cost

UV LED inks and curing units are more expensive than current UV technologies. In the digital arena, UV LED curing is a standard on most UV Inkjet platforms. Many press manufacturers now offer UV LED as an option if a customer is purchasing a new press. For customers looking to take advantage of the latest technology, many UV LED manufacturers are offering retrofits to existing presses. UV LED curing solutions for both new and retrofit narrow web presses, offer higher yields and decreased operating costs for increased profitability.

UV LED technology enables ink manufacturers to provide true low-migration ink solutions for food packaging.

* Forte, V. C. (n.d.). Technical Articles: Understanding Ultraviolet LED Applications and Precautions. Retrieved from http://www.marktechopto.com/understanding-ultraviolet-LED-applications-and-precautions.cfm

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16054, 03/2016, PDF

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