UV LED LIGHT SOURCE

OAI introduces our second generation of UV LED light sources. Our new line of LED light sources is built with the same standards of quality and performance that we've become known for with our mercury arc light sources, but now with the advantages inherent in solid state technology. Our line of UV LED light sources has applications in photolithography, curing, micro-fluidics, and biomedical activations. This new line of light sources can be integrated into an OEM application, used with an OAI mask aligner, retrofitted onto a legacy mask aligner, or purchased as a stand-alone exposure tool.

ADVANTAGES OF AN LED LIGHT SOURCE

There are several advantages inherent in a light source powered by LED's vs a traditional mercury arc lamp. The two main clear-cut advantages are energy consumption and cost of ownership. A mercury arc lamp must remain on during the entire time that exposures are being performed. When power supply efficiency is taken into account, a 1000W mercury arc lamp is consuming even more than 1000W of power. During an 8-hour production cycle, the lamp may remain on for more than 9 hours, for more than 9kWH of energy consumption. In contrast, an LED LS would only be on during the actual exposure time of the process. For example, if the exposure is 10 seconds long, and occurs once per minute, over an 8 hour shift the total exposure time would be 1.33 hours. At 1000W, the total energy consumption of an LED LS is only 1.3 kWH, an energy savings of more than 6X!

The second main disadvantage of mercury arc lamps is their lifetime, which contributes to their higher cost of ownership. Most lamps require changing after about 1000 hours of use. Lamp changes require the tool to be taken offline to facilitate the change, further increasing cost of ownership. Typically, a recalibration of the intensity control loop is also required potentially leading to process variation and yield loss. In contrast, an LED light source requires no lamp change. The LED's have a very long life, and are only on during actual exposure time. This allows the light source to be capable of millions of exposures before the end of life is reached.

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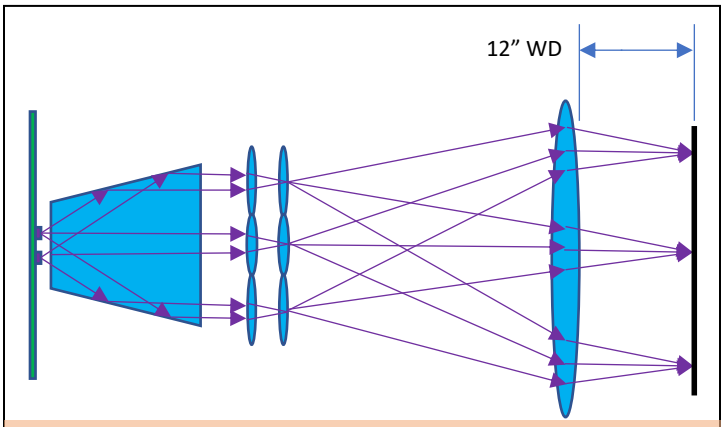
LED LIGHT SOURCE DESIGN

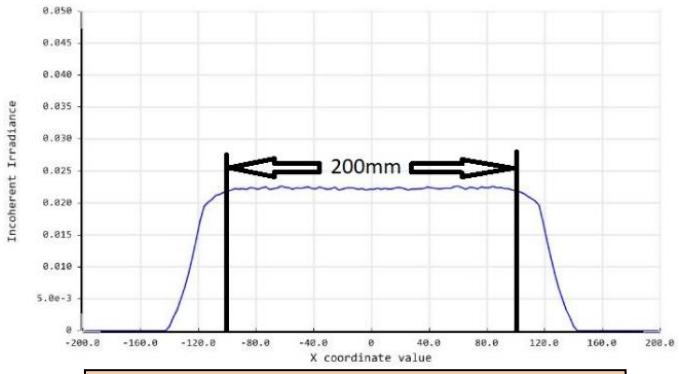
The OAI LED LS is designed such that the natural aging of individual LEDs in the system does not impact the quality of the beam coming from the light source. The light is collected from the LED's and collimated before passing through a set of micro-lenses, which homogenize the beam. Finally, the light is fully collimated into a very uniform beam with small divergence angles. This design produces excellent beam quality, enabling users of the OAI LED LS to achieve the highest performance in contact and proximity photolithography. The interface is a simple touch screen which gives the user full control over the output power of the light source as well as the ratio of desired wavelengths in the case of a multi-wavelength system.



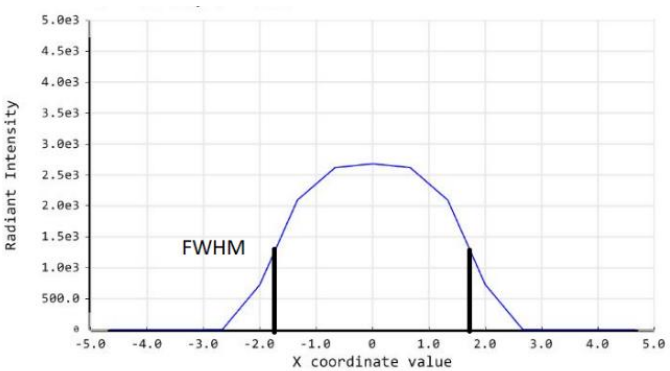
SYSTEM DIAGRAM SHOWING LIGHT COLLECTION, HOMOGENIZING LENS, AND FINAL COLLIMATION

LED LIGHT SOURCE PERFORMANCE

The OAI LED light source offers excellent performance characteristics. Typical irradiance uniformity is +-3%, and the collimation angle is <2.5°. In order to achieve precise and repeatable exposures, all OAI LED light sources come equipped with intensity and dose control. Beam characteristics of a typical 8" square LED LS are shown below, with a flat spatial uniformity of intensity profile and a FWHM radiant intensity as a function of collimation angle of 1.8°.



CROSS-SECTION OF BEAM SHOWING USABLE AREA



RADIANT INTENSITY AS A FUNCTION OF INCIDENT ANGLE

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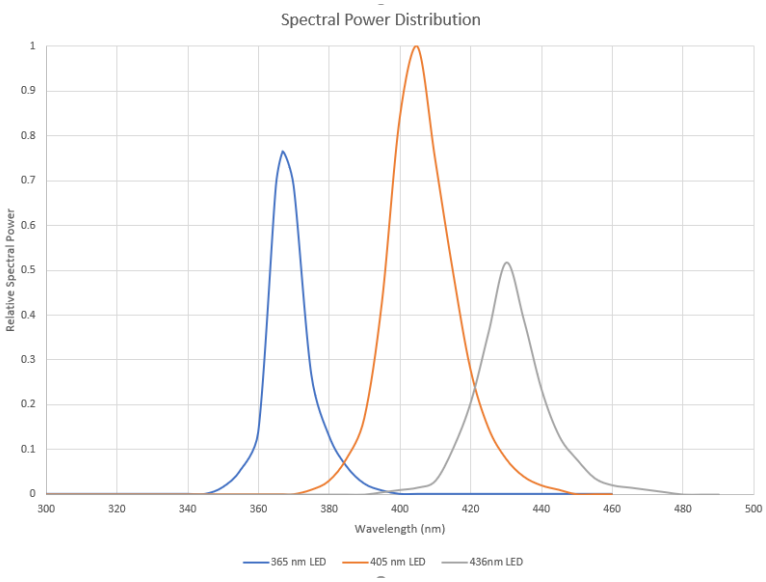
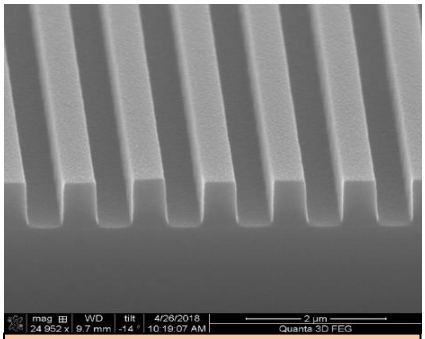
LED LS CONFIGURATIONS

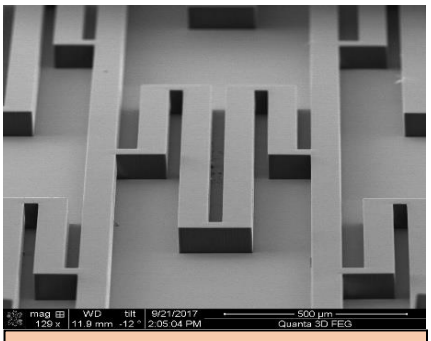
The LED LS comes in uniform beam sizes of 4” square, 6” square, 8”, and 12” square. It can be configured as a single wavelength system or a dual wavelength system. Available standard wavelengths are 365nm, 405nm, and 436nm, all of which mimic the mercury arc lamp spectrum that photoresists have been optimized for, although other wavelengths are available upon request. Spectrums of each standard wavelength and their relative integrated power are shown below.



Specifications/Model #	LS 32-4	LS 32-6	LS 32-8	LS 32-12
Beam Size	4in x 4in	6in x 6in	8in x 8in	12in x 12in
Intensity @365nm	55mw/cm2	40mw/cm2	20mw/cm2	8mw/cm2
Intensity @405nm	60mw/cm2	45mw/cm2	22mW/cm2	9mw/cm2
Intensity @436nm	55mw/cm2	40mw/cm2	20mw/cm2	8mw/cm2
Spatial Uniformity	<+-4%	<+-4%	<+-4%	<+-5%
Collimation Angle	2.4°	2.2°	1.8°	1.4°
Wavelengths Available	365nm, 405nm, 436nm or any pair combination			



500nm lines and spaces printed with OAI’s LED LS



50um thick SU-8 printed with OAI’s LED LS

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