

# 研晶光電(HPLighting)

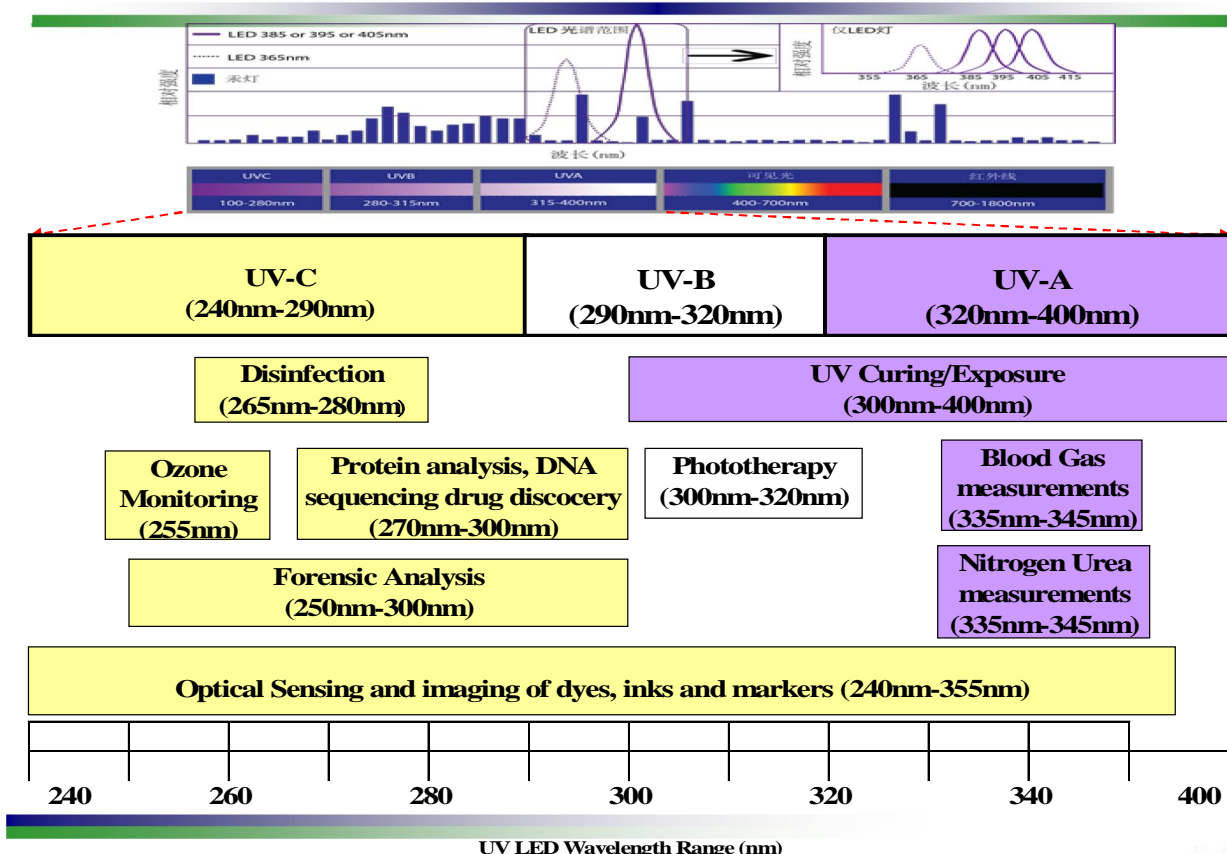
iLED (Industrial, Invisible, Innovation LED) Leading Company

UVA LED - applications and its technical challenges

Charles Wei Ph.D.- Chairman & President  
 Oct. 23rd, 2015  
[www.hplighting.com.tw](http://www.hplighting.com.tw)



## UV Applications



# UV Lamp vs UV LED

UV Lamp	Bulky Structure	Compact Structure	UV LED	Easy integration
	High Power Consumption	Low Power Consumption		Instant on/off No warm-up/cool-down cycle No shutters needed
	Long Standby time	Short Standby time		Near ambient array housing temperature Negligible heat transfer to surface No conditioned plant makeup air
	High Heat Generation	Low Heat Generation		No ozone, No system exhaust
	Mercury used	No mercury used		Wavelength by Applications
	Broad Spectrum	Narrow Spectrum		Optical design flexibility
	Omni Direction Optics	Directional Optics		



## UV LED (365nm-420nm) applications

Application: UV Curing/UV Disinfection/UV Exposure  
 Industry: Printing/Medical/Assembly/Exposure (PCB, LCD)

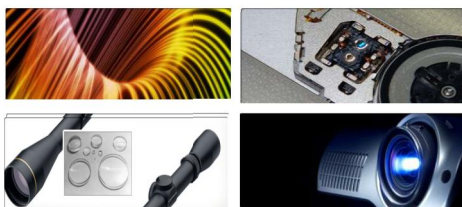
### Medical



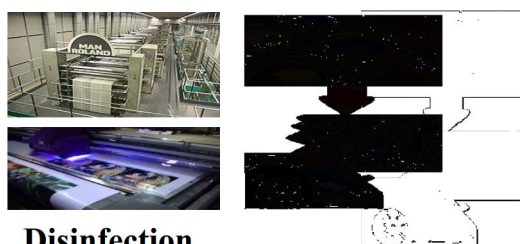
### Electronics Assembly



### Opto Electronic



### UV Printing & Coating



### UV Exposure

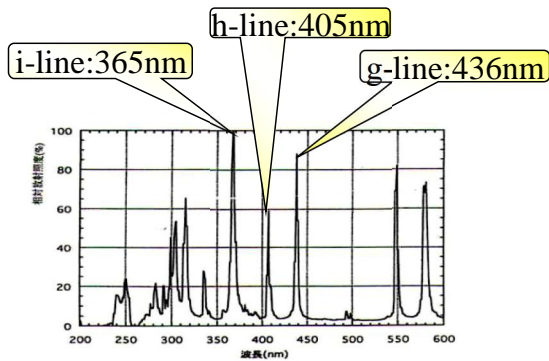


### Disinfection



# Key for UV LED to replace UV Lamp?

## UV Lamp System



## UV LED System

### Requirements:

Mixed wavelength:

365nm/385nm/395nm/405nm/430nm (Materials related)

Intensity: W/cm<sup>2</sup> (100mW~20W/cm<sup>2</sup>)

at certain Working Distance (1mm~150mm)

Energies: Joule/cm<sup>2</sup> (ink, varnish, glue, photoresist)

Incident Angle: (1° ~ /60°)

Uniformity : >85%

Thermal Solution: Air cool/Water Cool

Reliability: >20,000 hrs

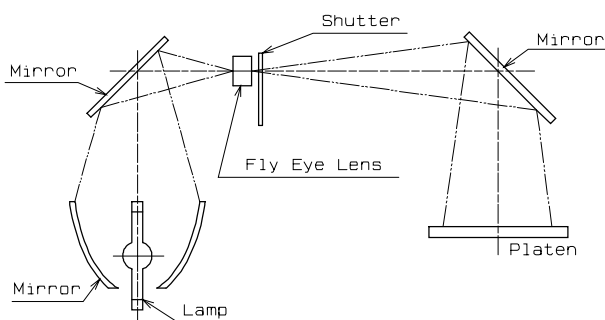
Highly Customization and Technology Oriented

Application Requests: Collimated Light · High Irradiance

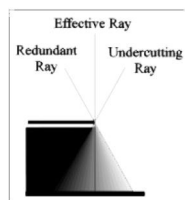


## UV Collimated Optics: PCB /LCD Exposure

Collimated  
平行光 DA: 1~2°

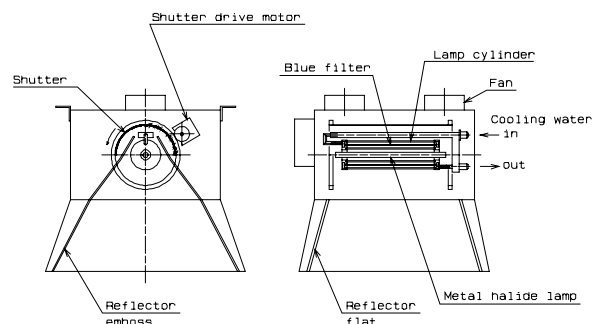


Short Arc: 汞氙短弧燈  
平行光曝光用 / 3.5, 5, 8 Kw



Flood  
散色光 DA: 10~25°

10KW LIGHT SOURCE FOR AC620



Long Arc: 水銀燈/金屬鹵化物燈  
防焊曝光用 / 7, 8, 9, 10 Kw



# UV LED Collimated Light Applications

**Applications: UV Exposure**  
**Industry: (PCB,LCD) Exposure**



## Requirements:

*Mixed wavelength:*

*365nm/385nm/395nm/405nm/430nm*

*Intensity: W/cm<sup>2</sup> (100mW~1W/cm<sup>2</sup>)*

*at certain WD ( 50mm-150mm)*

*Energies: Joule/cm<sup>2</sup> ( Photoresist)*

*Incident Angle: (1° ~ 6°)*

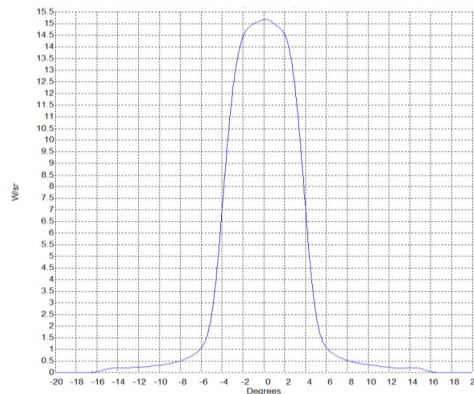
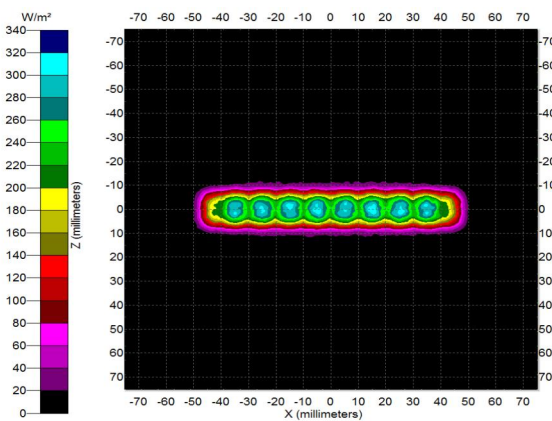
*Uniformity :>85%*

*Thermal Solution: Water Cool*

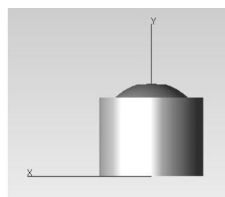
*Highly Customization*



## UV LED : 4° Collimated Light



*4° collimated UV LED light:*  
*Point >> Line >> Plane*



**Technologies:**

*Quartz UV LED Package*

+

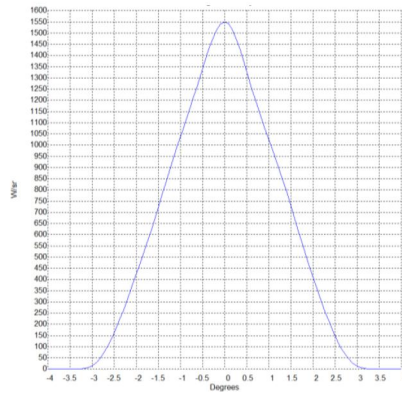
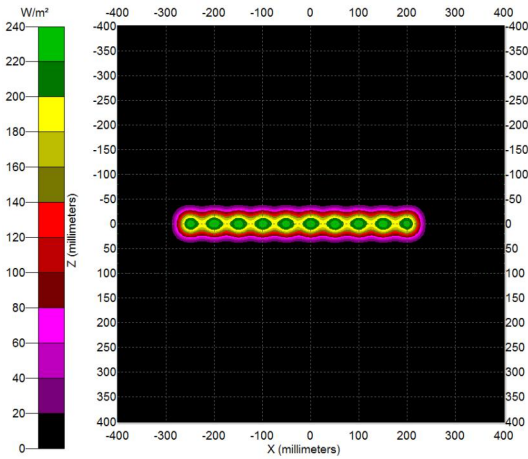
*Optical Design and Arrangement*

– Line Width / Line Space

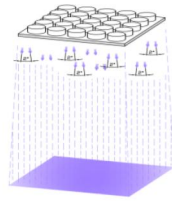
– 30µm/ 30µm



# UV LED : 2° Collimated Light



2° collimated UV LED light:  
Point >> Line >> Plane



Technologies:  
UV LED Optical Module  
and Arrangement

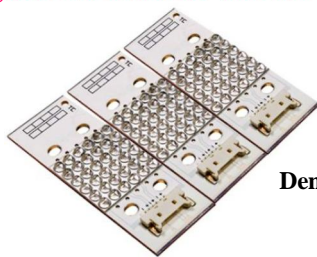
– Line Width / Line Space  
–20μm/ 20μm



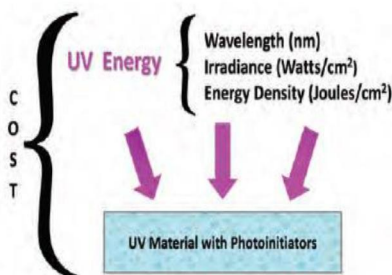
## UV LED High Irradiance Applications

Application: UV Curing  
Industry: Printing/Curing/Assembly

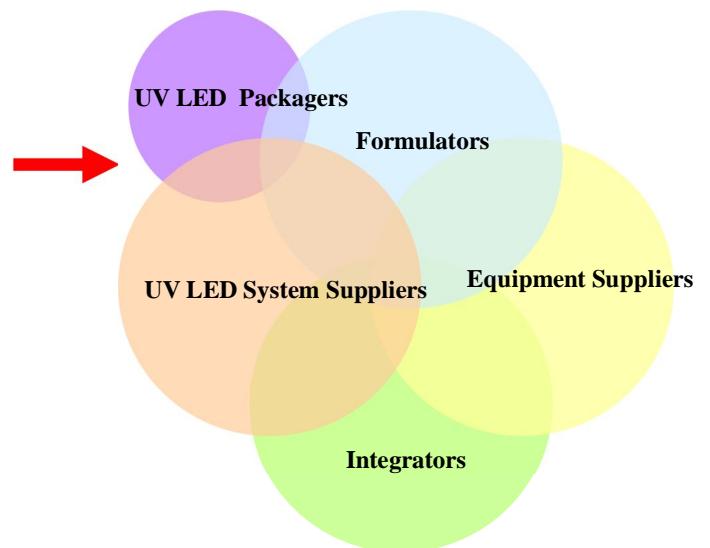
Highest Irradiance W/cm<sup>2</sup> : 8~20W/cm<sup>2</sup>



Dense and Focusing Structure



Highly Integration with Vendors and Customers



# UV LED High Irradiance Applications

**Thermal Solution: Air cool/Water cool**

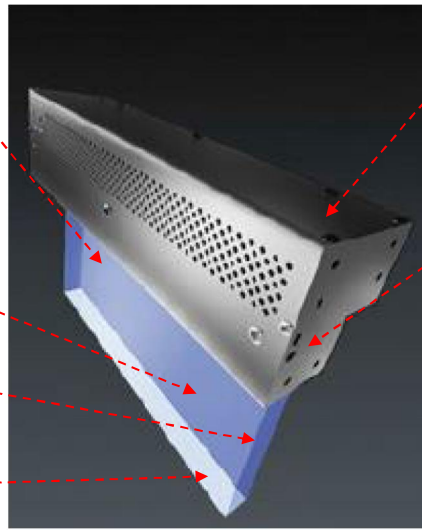
**Mixed wavelength:  
365nm/385nm/395nm/405nm/430nm**

**Intensity: W/cm<sup>2</sup> (4W~20W/cm<sup>2</sup>)  
at certain WD ( 1mm-100mm)**

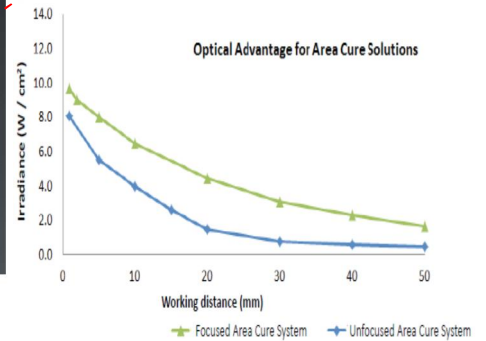
**Energies: Joule/cm<sup>2</sup> (ink, varnish..)**

**Incident Angle: (less than ~ 60°)**

**Uniformity :>85%**



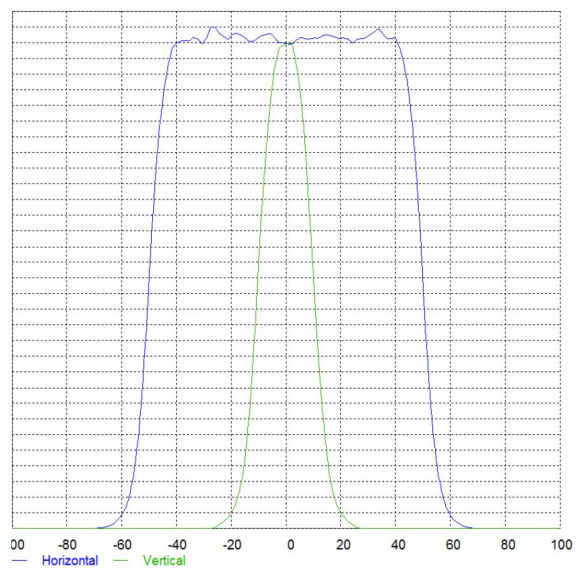
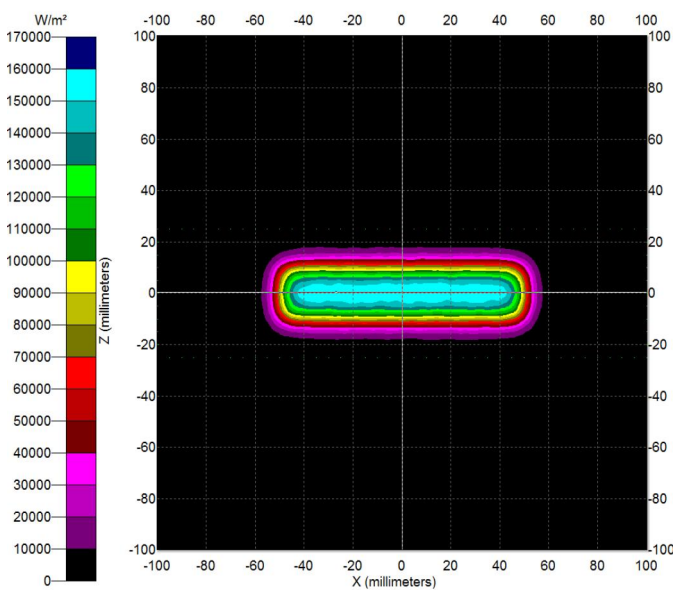
**Optical Design**



**Highly Customization**



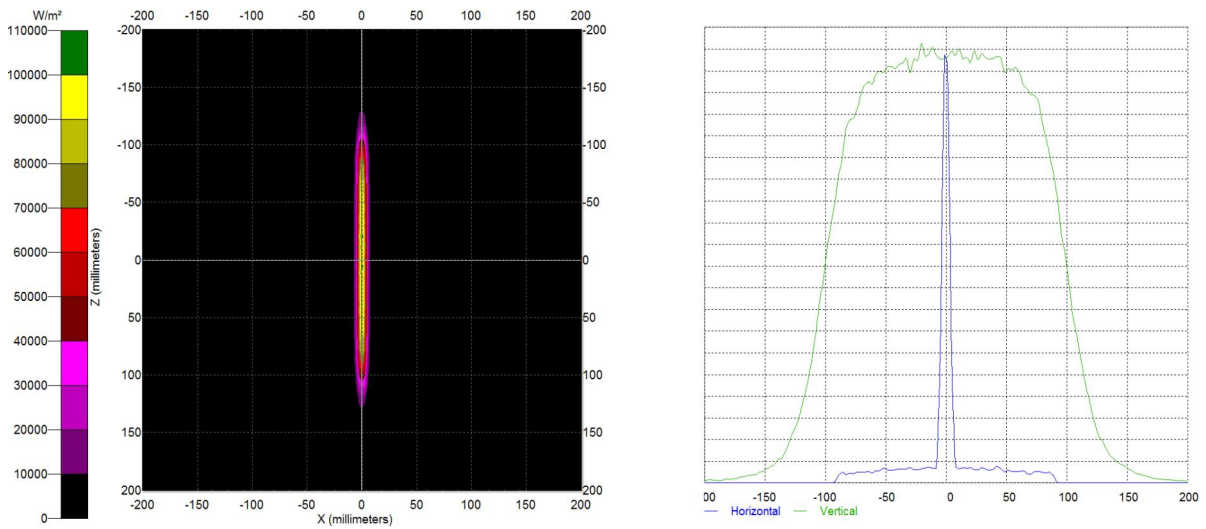
## UV LED with Short WD and High Irradiance



**WD: 3mm~30mm , Irradiance : 12W~20W/cm<sup>2</sup>  
Printing, Curing, Coating....**



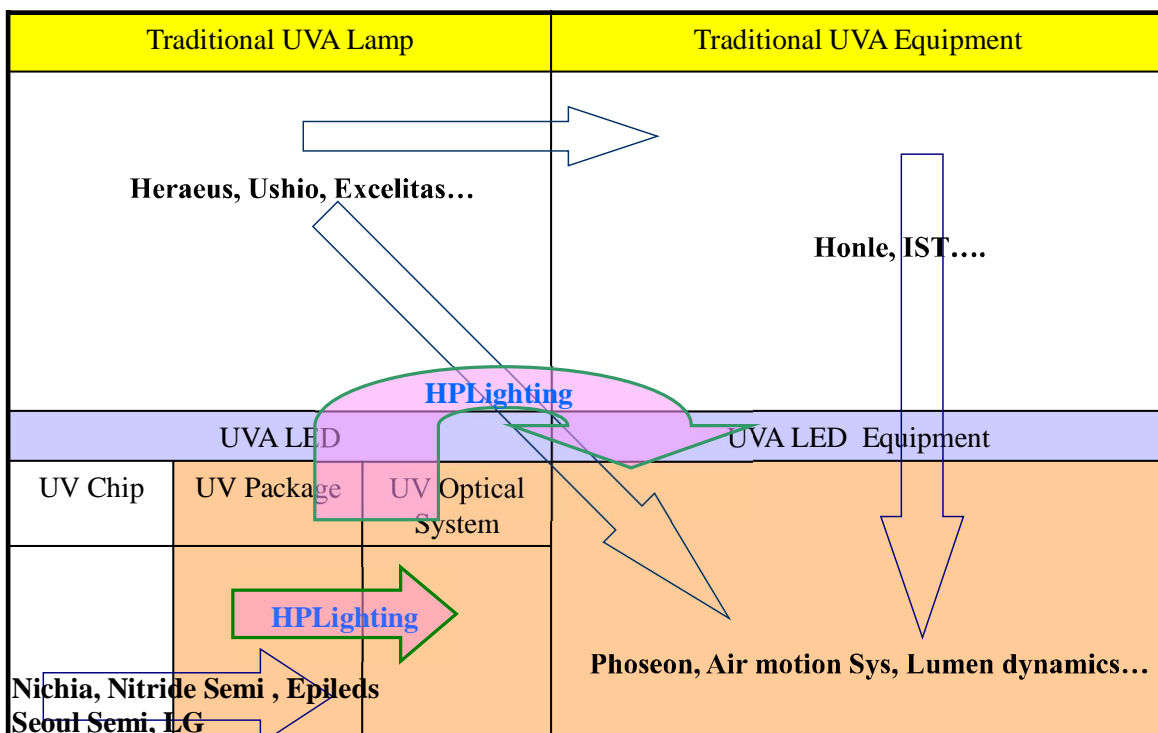
# UV LED with Long WD and High Irradiance



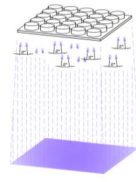
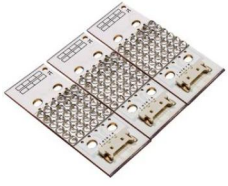
*WD: 100mm , Irradiance : 6W-10W/cm<sup>2</sup>  
High Speed Printer (>100~200m/min)...*



## UVA LED Business Strategies



# HPLighting UVA LED in-line



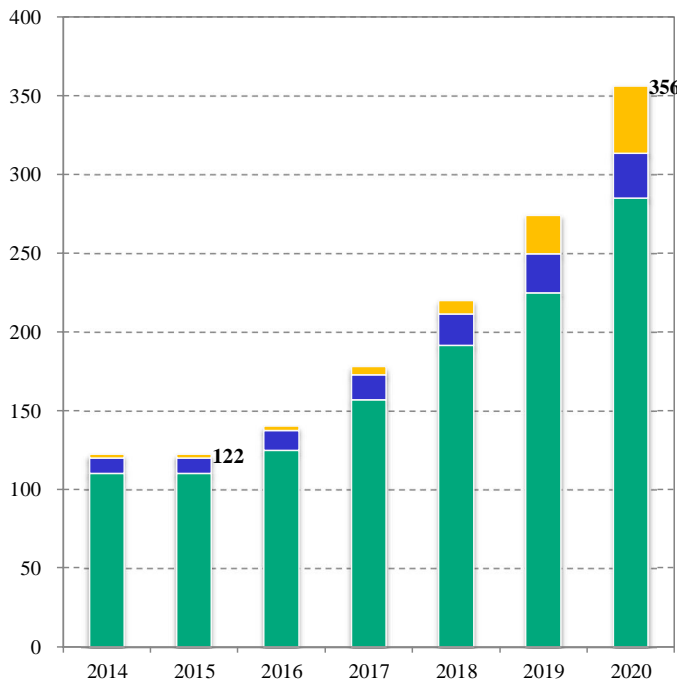
<b>UV LED</b> <i>Customized UV COB module</i>	<b>UV LED Optical System</b>	<b>Thermal system</b>
<i>Angle: 15° ~ 120°</i>	<i>Angle: 1° ~ 6°</i>	<b>Water Cool:</b> <i>&gt;4W/cm<sup>2</sup> , &gt; 800W, Clear Room, Quiet</i> <b>Air Cool:</b> <i>Simple , Cost efficiency, Noisy</i>
<b>QMC: Quartz Micro-Lens Cu Substrate Platform</b>	<b>Optical Design</b> <b>Optical Module System</b>	
<b>365-430nm</b>		
<i>4W~20W/cm<sup>2</sup></i>	<i>100mW~1W/cm<sup>2</sup></i>	



## UV LED Market Forecast

2015-2020 UV LED Market Scale

UV LED Market By Technology



	CAGR 2015-2020
UV-A LED	21%
UV-B LED	24%
UV-C LED	77%
<b>Total UV LED Revenue</b>	<b>24%</b>

Source: LEDinside, October 2015





# *UV LED business is Sweet, but Barrier there*

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## *UV-A LED Business*

### ***Characteristics:***

*Highly Customization and Total Solution Needed  
( Not a One-Size-Fits-All)  
Service Oriented Business Model*

### ***Challenges:***

*High Irradiance  
Collimated Optics  
Cost*

### ***Opportunities:***

*High Growth Rate ( New and Retrofit)  
New Applications*

*Don't think sunscreen when hearing UV, think purple LED!*

