

先进等离子体照明 Advanced Plasma Lighting

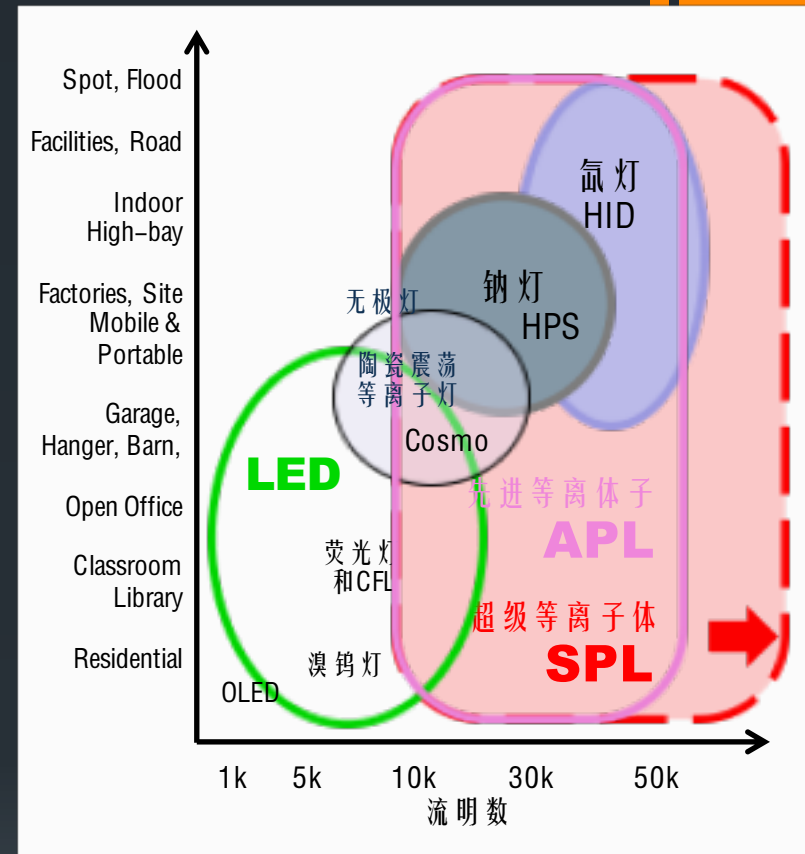
1

一、技术和产品 Technology & Products



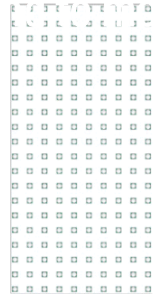
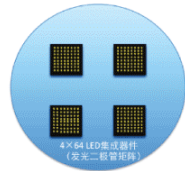
APL Range of Applications

- ◆ 光强：1万~10万流明 High light intensity – 10,000 lumens to 100,000 lumens
- ◆ 寿命：灯泡5万小时，驱动器10万小时 Long life – Bulb 50K hours & Driver 100K+ hours
- ◆ 节能：节电40%+ 同等光效相对HID或LED：2换3 Energy savings of 40%
- ◆ 光电效率：APL每瓦120流明。荧光灯(每瓦60流明), LED(每瓦110~130流明); 高压钠灯(每瓦90流明); 金卤灯(每瓦70流明) Exceeds brightness levels of Fluorescent, LED, HPS, HID at same power rate
- ◆ 网络化智能控制：就绪 Intelligent Lighting and IoT-ready
- ◆ 连续调光：100%~20% Continuous dimming
- ◆ 整批调整和校准的显色指数和色温：CRIs of 70-95 and CCTs of 3,000-6,500 (K)
- ◆ 维护：灯泡可被单独更换 Replaceable Bulb
- ◆ “单个高光能点光源”：保障理想光学设计对光照的控制和指向，可达到“最省一次光学（最小和最轻反射结构），省去二次和三次光学等透镜设计”，达50%的实际光效提高：Single Point Light Source for high-intensity – Efficient & Smaller Luminaires

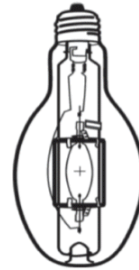


Size & Volume of Light Source (example)

An APL light source is very small. Its “point” light source, is the ideal case to optical designers.



200 LEDs
(发光二极管矩阵)



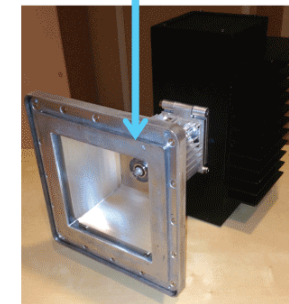
APL don't need “secondary optics” or “lens”, simply an ideal reflecting design is enough for the best.



LED High-bay: 15,000LM/150W
Circuit Box: D=300mm, Depth=240mm
Reflector: D=650mm, Depth=385mm



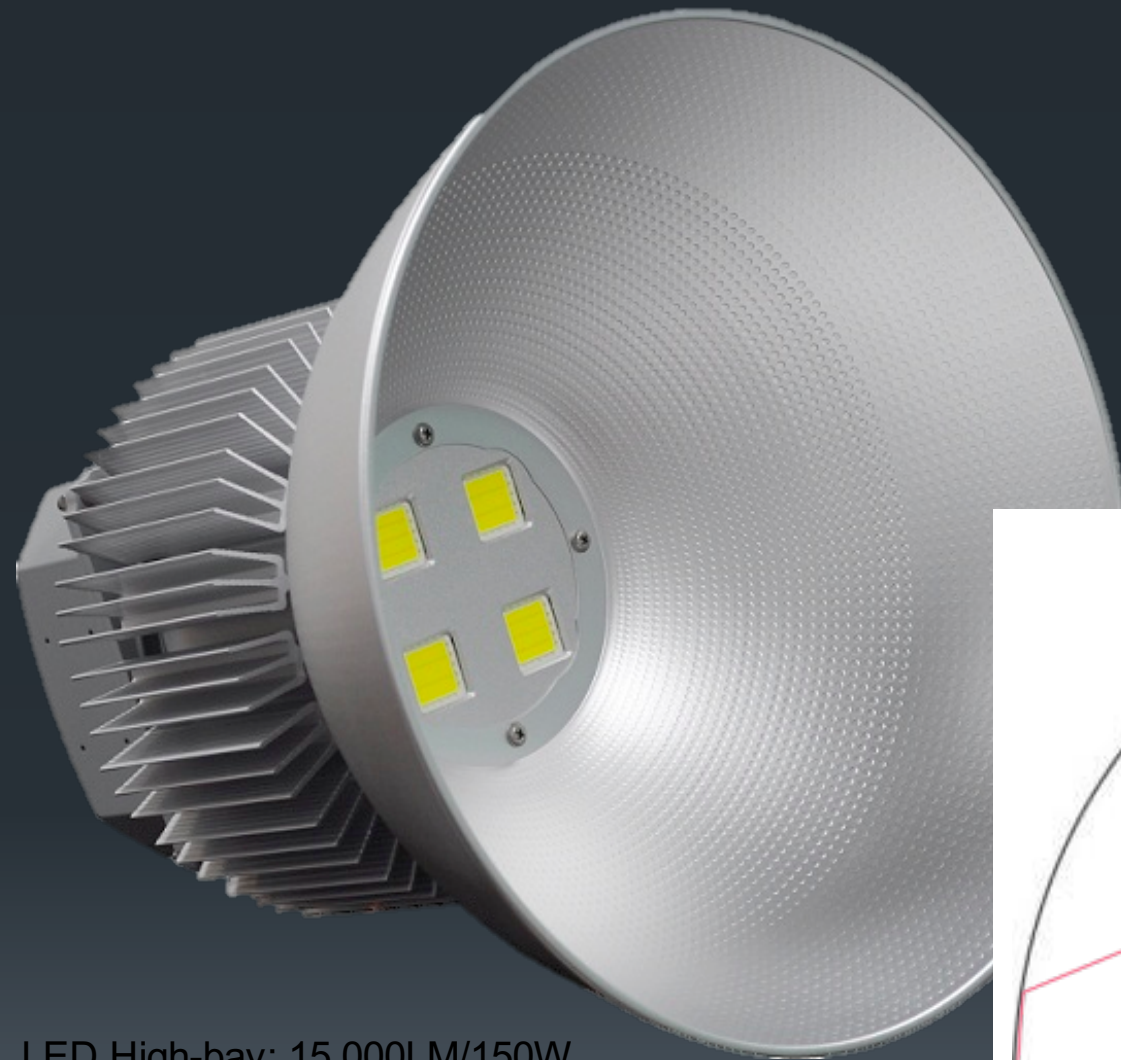
HID High-bay: 28,000LM/400W
Circuit Box: D=200mm, Depth=200mm
Reflector: D=590mm, Depth=310mm



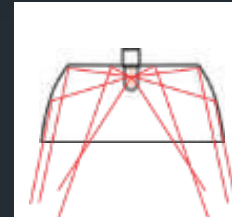
APL High-bay: 28,000LM/235W
Circuit Box: 220x220sqmm
Reflector: 220x220sqmm

单个点光源
Single Point
Light Source

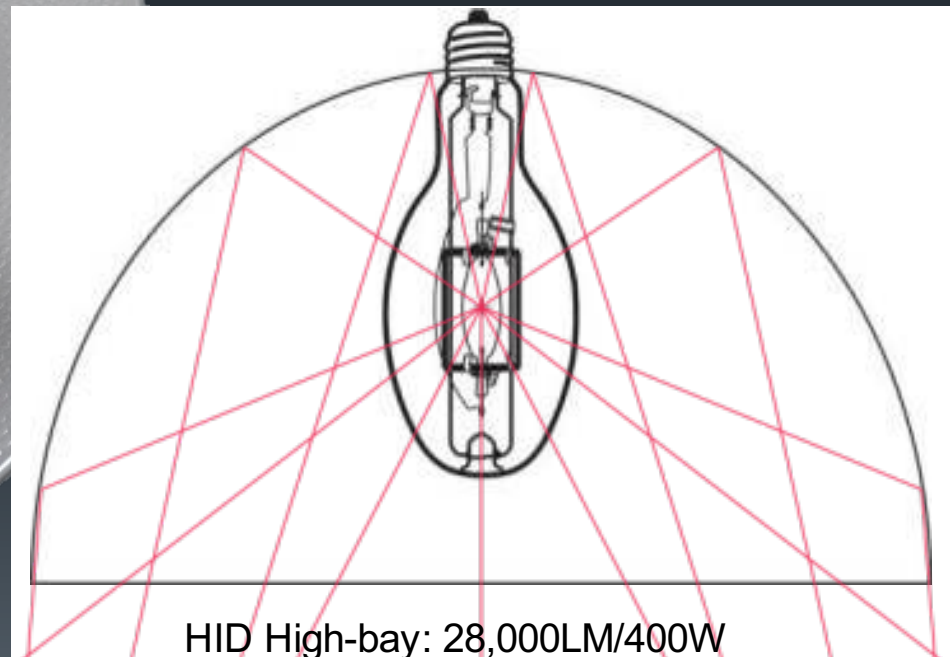
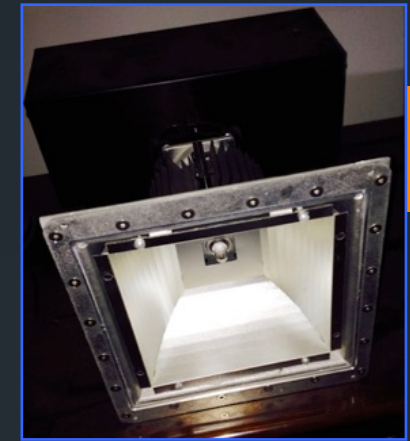
Reflector Optics (Examples)



LED High-bay: 15,000LM/150W
Circuit Box: D=300mm, Depth=240mm
Reflector: D=650mm, Depth=385mm



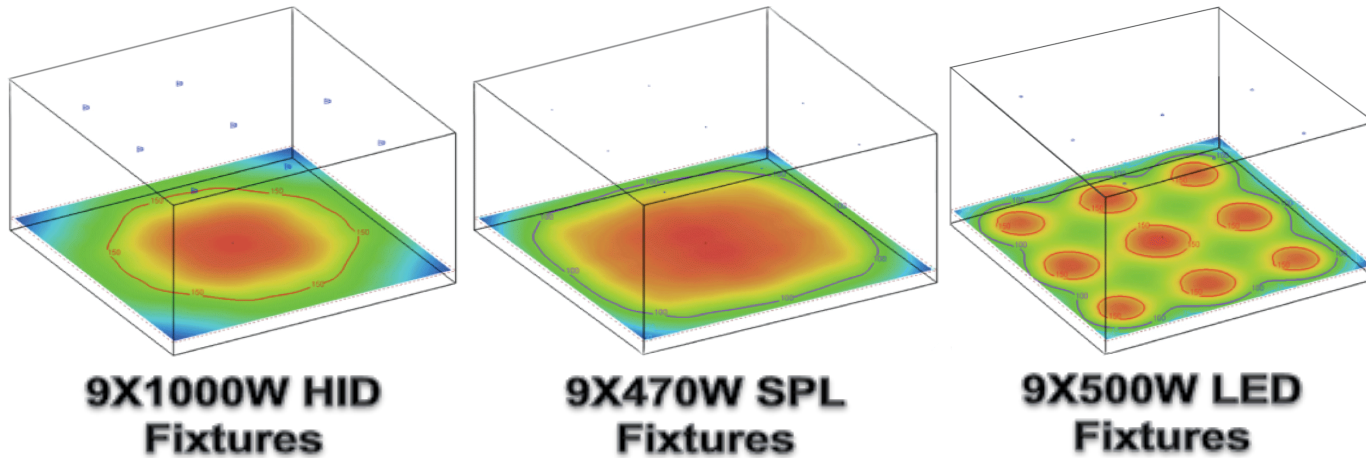
APL High-bay: 28,000LM/235W
220x220sqmm
Reflector: 220x220sqmm



HID High-bay: 28,000LM/400W
Circuit Box: D=200mm, Depth=200mm
Reflector: D=590mm, Depth=310mm

(统一尺寸比例)

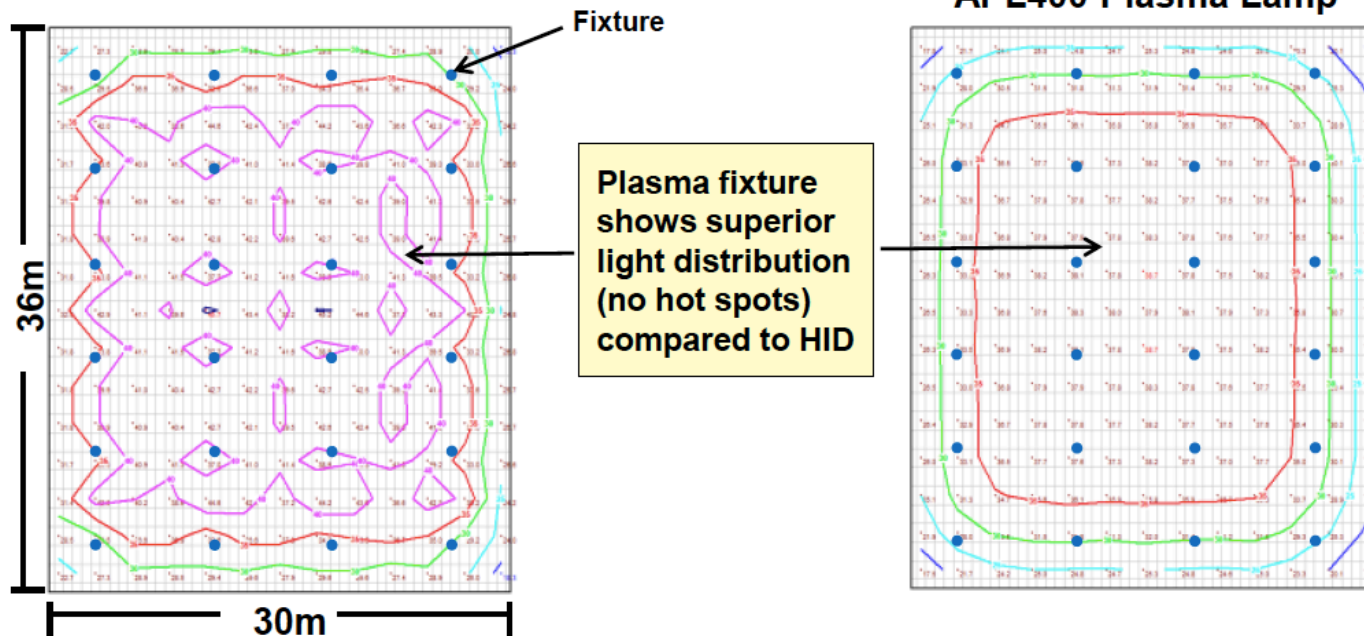
Light Projection (Example)



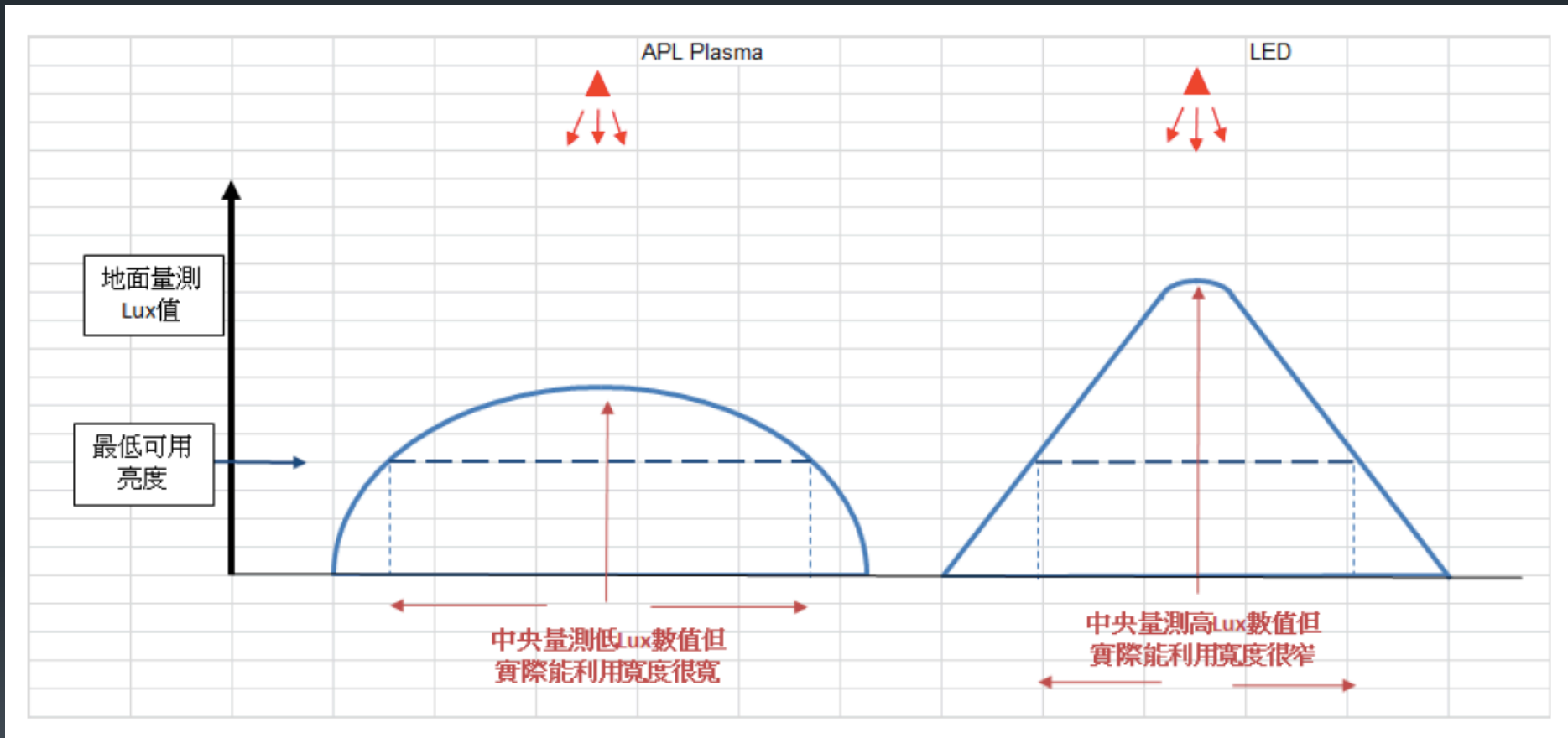
8 meter Mounting Height, 24 Fixtures, 36 m x 30 m Warehouse

458W HID High Bay

235W High Bay w/ Topanga's APL400 Plasma Lamp



Combined Volume of Lighting (Exmample)



High-bay Light



APL compares to CFL or LED, its has a better combined lighting volume,
high efficiency projection, smaller reflector, no glair

Courtesy Topanga Technologies, Inc. Copyright © 2013–2014 by IMEC USA, LLC

APL replacing HID, with higher-efficiency, and better effects

Save 40% of electric bill, get much better lighting effect



400W HID



235W APL (the lighting equivalent to 400W HID)



APL in a Factory (Los Angeles, California)



APL in a School Basketball Court (Calgary, Canada)

Target market sectors of highest energy consumption and lumen productions

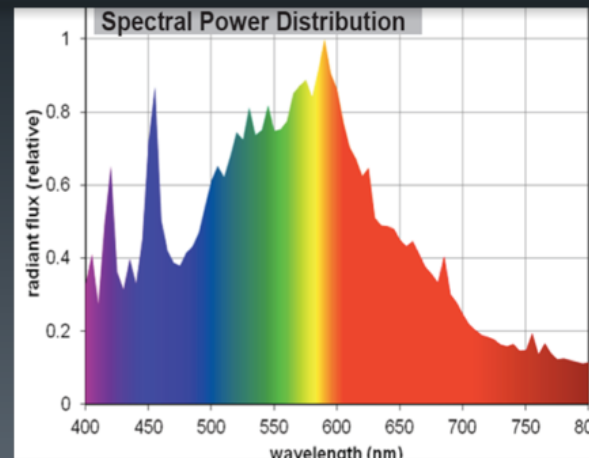
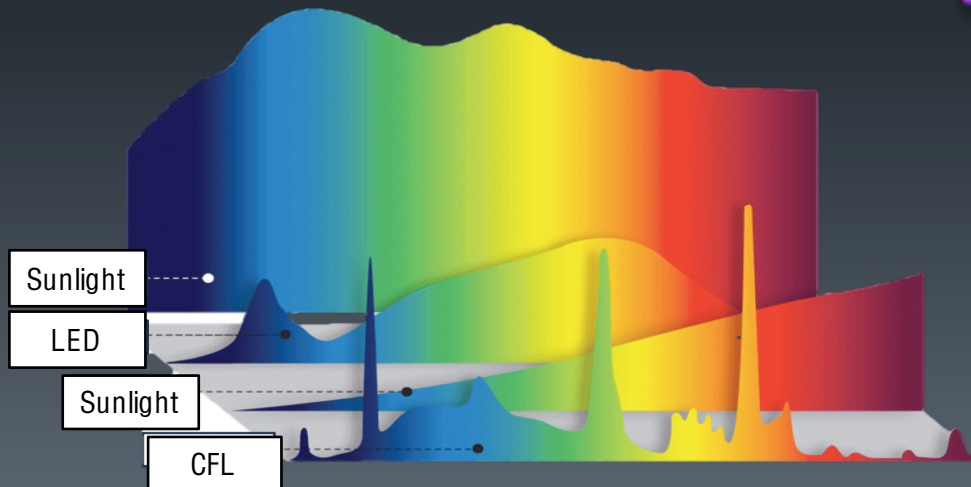
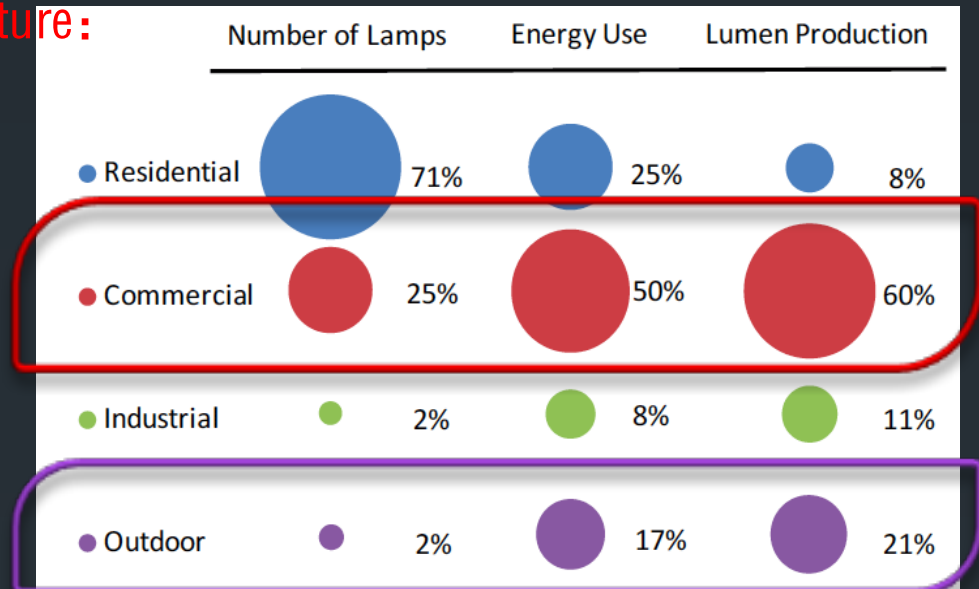
Commercial Lighting: share with All Natural Lighting's Light Engine, Light Guide Distribution System and Electric-free Light Fixture:

- ◆ High-power Sun Light Collector
- ◆ Organic APL Engine

Outdoor Lighting: APL Engine

- ◆ The most close to Natural Light Spectrum
- ◆ No Glair Healthy Lighting
- ◆ Perfect Combined Lighting Volume

Complies with International Carbon Neutral Projection toward 2030, Also Healthy Lighting



APL Spectrum Is the most close to the Sunlight

APL

三、Initial Industrial Cluster

Beijing/US: Patent & IP Pool, APL Industrial Alliances

Ningbo Manufacture Tech Center and Production: Systems & Fixtures

Initial Supply Chain: Ningbo, Ninghai, Huizhou



APL

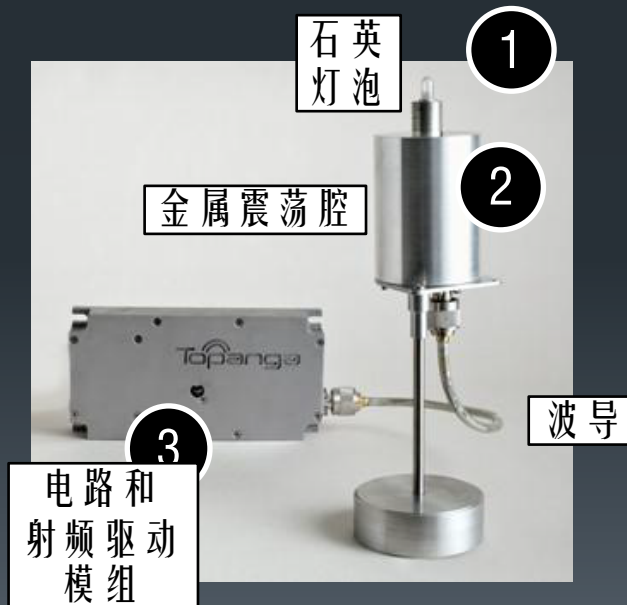
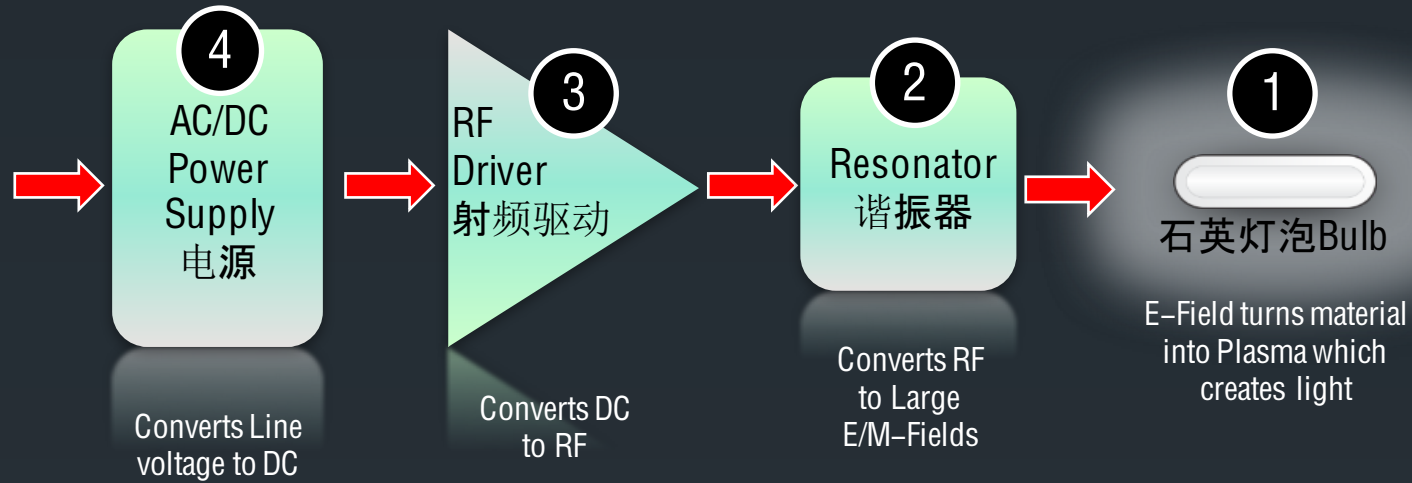
Appendix 1

附录1：技术和制造工艺

Tech, Products and manufacturing processes



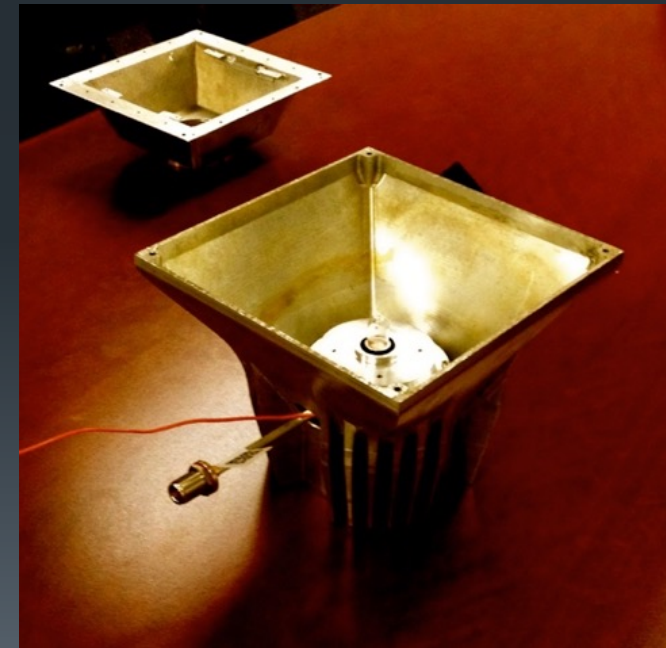
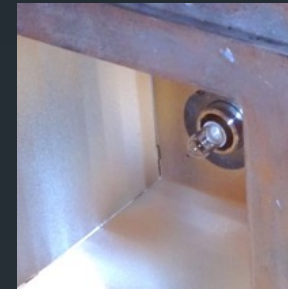
APL Engine



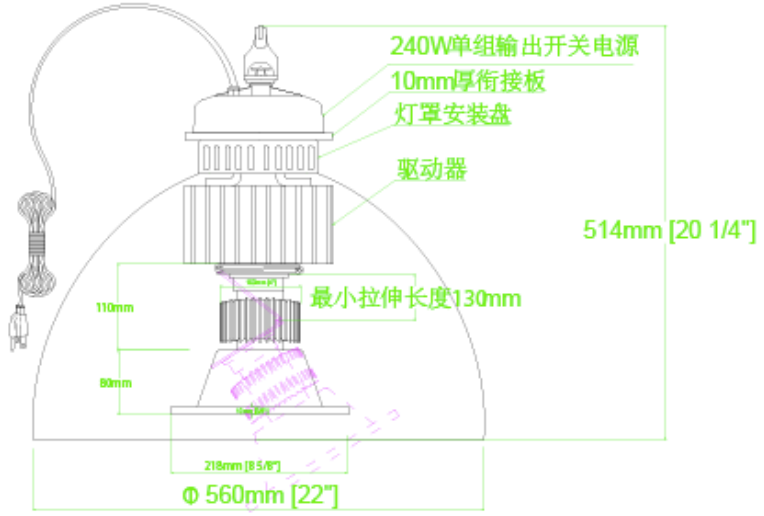
4 Standard Power Supply (110-240vAC – 24vDC) compatible to LED power modules

APL
Appendix 2

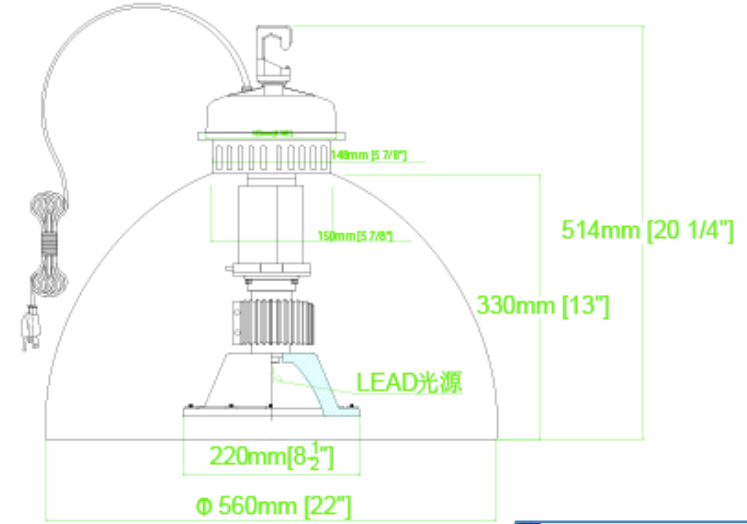
附录2. APL 产品细节 Products Details



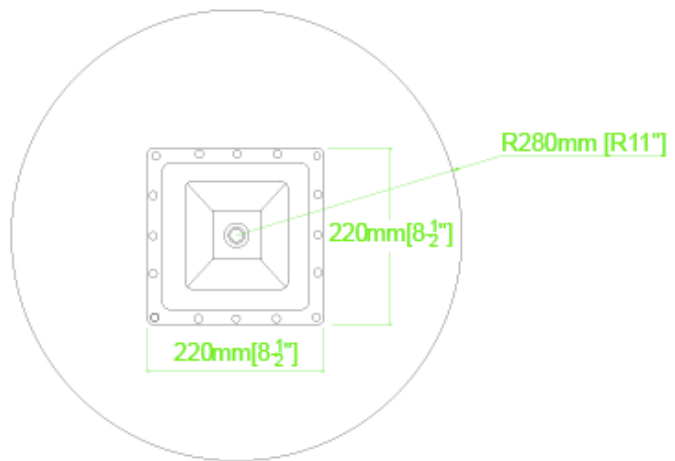
An HID Fixture Retrofit APL (High-Bay)



正视图



左视图



仰视图

Thomas Research Products

250W TRV-250 Series
Switch Mode LED Drivers
Constant Voltage
Aluminum Housing

Electrical Specifications

Input Voltage Range	100-277VAC, 50/60Hz, 100V-100V
Power Factor	0.99 to 1.00, PF @ 100V-100V
Output Voltage	350VDC, 350VDC (regulated)
Output Current	0.714A, 0.714A (regulated)
Load Regulation	<1%
Line Regulation	<1%
Temp. Drift	<0.1% (0°C to 50°C)
Efficiency	>90%
Power Dissipation	25W (max) @ 100V, 100V Input
Power Factor	>0.99
Power Factor	>0.99

Environmental Specifications

Maximum Case Temp.	100°C
Storage Temperature	-40°C to 100°C
Operating Temperature	-40°C to 100°C
Humidity	5% to 95% RH, non-condensing
Shock	100g, 10ms, 1000 cycles
Vibration	10g, 1000 cycles
EMC	CE, FCC, UL, VDE, etc.

UL **CE** **IP67**

NOTICE OF COMPLETION AND AUTHORIZATION TO APPLY THE UL MARK

Topanga Technologies, Inc.
Attn: GREGG HOLLINGSWORTH
2125 Veterans St.
Carpenter Park, CA 91303-2823, United States

Our Reference: File E36525, Vol. 1
Your Reference: N/A
Project Scope: E36525 - RE-BUILD OF VIM 1140081228 - NON-COMPLIANCE ITEMS

Dear Mr. GREGG HOLLINGSWORTH:

Congratulations! UL's investigation of your product(s) has been completed under the above Reference Number and the results are favorable to compliance with the applicable UL standards. To take advantage of our services, please contact our Customer Service Department at 1-800-368-5868 or visit our website at www.ul.com. For more information on our services, please visit our website at www.ul.com. For more information on our services, please visit our website at www.ul.com.

Additional Requirements related to your investigation as the Applicant can be found in the document "Applicant Responsibilities under UL Mark Authorization" available on the front of the following website: www.ul.com

Any information and documentation provided to you involving UL Mark services are provided on behalf of UL, LLC or any authorized licensee of UL.

We are pleased to be your UL Marking Partner. We thank you for your products and appreciate your business. Please feel free to contact us for any of our Customer Service representatives if you have any questions.

Very truly yours,
Margaret A. Goss
+1 617 546-2629
Engineering Director
Margaret.A.Goss@ul.com

Reviewed by:
Kenneth A. Foster
912 945-1746
Staff Engineer
Kenneth.A.Foster@ul.com

MELCOCA-63648

UL

UL Report

APL Application Factors

“Key” specifications:






- ◆ Efficiency: High-intensity Lighting (10,000LM and above), 120LM per W.
 - ◆ SiN LED is 120+, all China Al₂O₂ LED is 100
 - ◆ HPS is 90, most popular HID is 70, APL is 130。
 - ◆ LED products needs secondary or third optical mechanism to improve or correct the light projection
 - ◆ HID (such Cosmo) has started to compete LED lighting at lower power end (150W and below). Still light source is big, heavy in mercury pollution, needed UV filter.
 - ◆ APL is the ideal “point” light source, does not need secondary optical, only need simple reflector designs.
- ◆ Glair: related to the nature of light sources. APL source is 1/100 of LED’ s integrated arrays’ .
- ◆ Life time: APL bulb is 50,000H, electronic driver is 100,000H, no performance decay at all
- ◆ Combined Lighting Volume: APL’ s “point” light source enables a 2-to-3 replacement of HID

“Secondary” effects:

- ◆ Adjacent light projections on ground or floor (between APL light projections, they are seamlessly continuous)
- ◆ Fixture volume and weight (APL is more compact and lighter)
- ◆ Complexity of the products, BOM also affect s reliability and maintenance costs (APL is the simplest)
- ◆ Sensibility to temperature rising (above 80 degree) along with the Light Decay (APL is not sensitive at all)
- ◆ Manufacture compatibility and retrofit to conventional industries, along manufacture cost and environmental impacts (APL has none)

High-bay Replacement to HID for Energy-saving

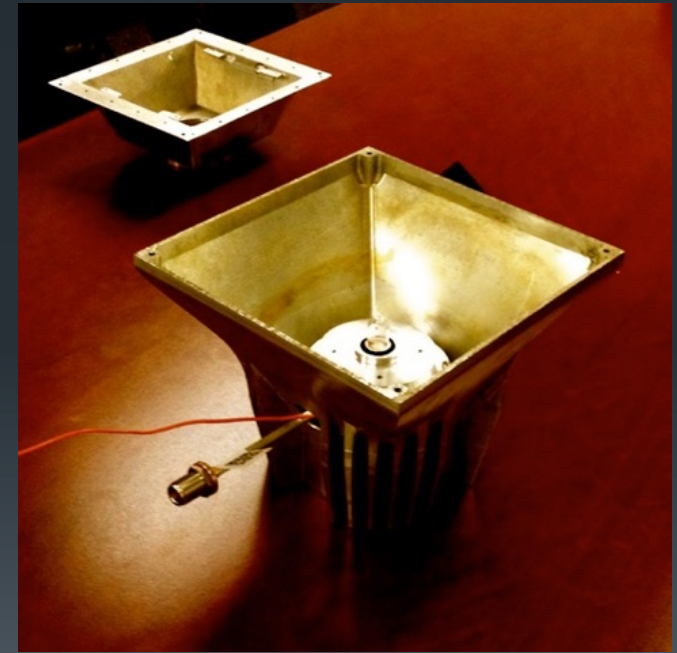
North America's lighting engineering services plan (1) from few stores spread out to 600+ stores of a leading US chain channel. One typical store needs 250-400W HID in quantity of 420 High-bays. Initial price is USD300.00 per light, that is USD 126,000. One such store's electric saving: (1) 30% less lamps are needed; (2) energy-saving 40% per lamp. 1-2 years of electric bill savings can fulfill the ROI.

	Stors 店铺数	Area Factor 面积因数	HID Lamps 灯安装个数	APL 灯数	单价 Unit Price	灯具销售 Sales
 CostCo	649	1.0	389,400	181,720	US\$200	US\$36,344,000
 Sam's Club	612	1.0	367,200	171,360	US\$200	US\$34,272,000
 Home Depot	2,248	0.5	674,400	314,720	US\$200	US\$62,944,000
 Office Depot	1,912	0.1	114,720	53,536	US\$200	US\$10,707,200
 Best Buy	1,005	0.5	301,500	140,700	US\$200	US\$28,140,000
Total	6,426		1,847,220	862,036		US\$172,407,200



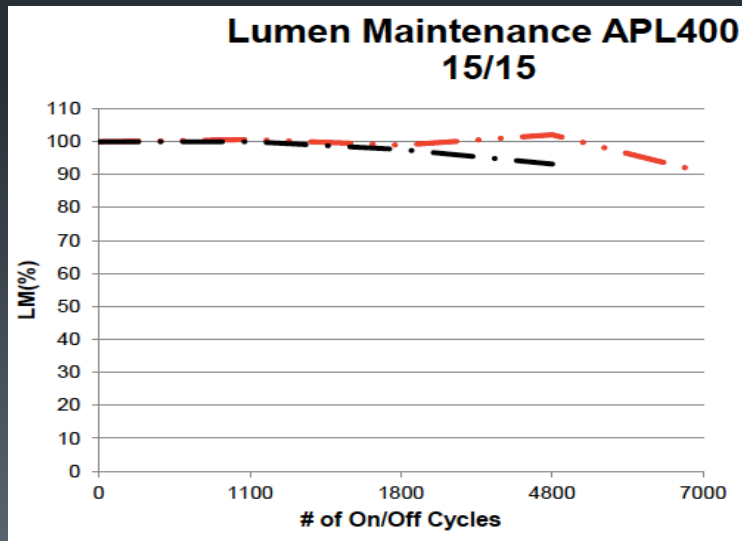
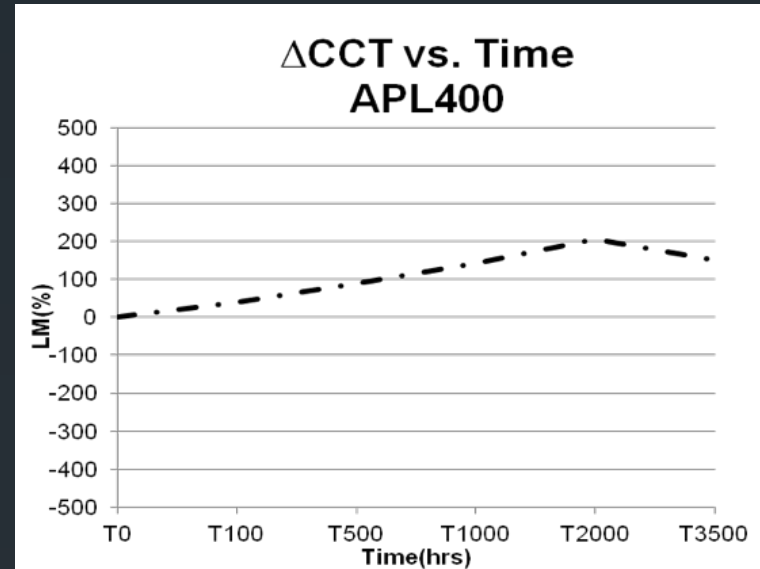
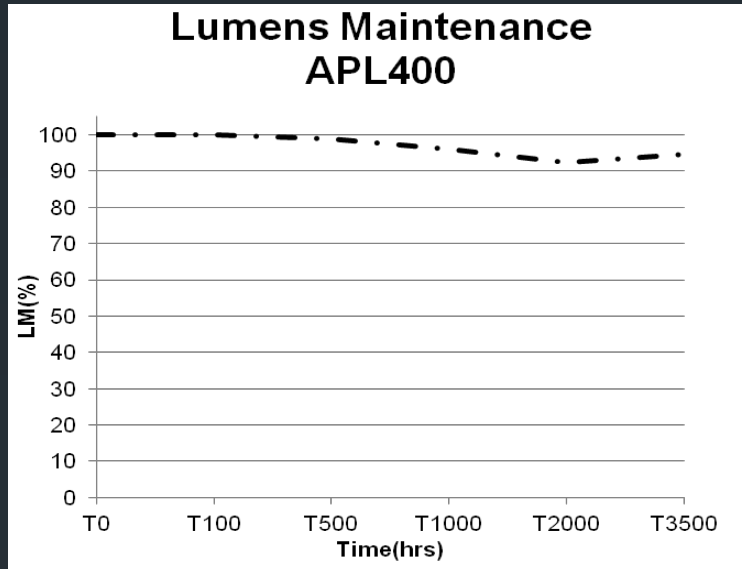
APL
Appendix 3

附录3：产品先进性和竞争力
Product Advantages & Competitions



APL Reliable & No Light Decay through long Life-span

正常使用光衰考核：周期 (T)：开灯11小时-关灯1小时 Standard Cycling T = 11 Hours On / 1 Hour Off



频繁操作光衰：考核周期 (T)：
开灯15分钟-关灯15分钟
Rapid Cycling T = 15 minutes on /
15 minutes off

— Group 1
— Group 2

5475 cycles = 15 years

APL Appendix 4

附录4. 历代的等离子体照明 PL History

APL is the latest and the most advanced.



等离子体照明的历史 History

Natural Plasma Lighting

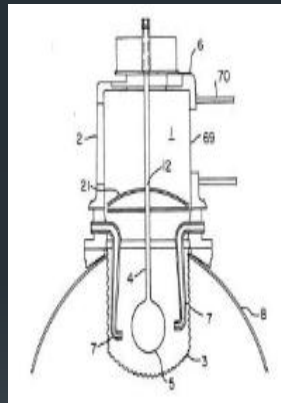


Lightening



Sun

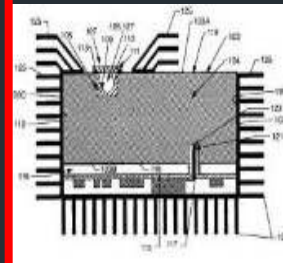
Fusion Lighting



硫灯生产

1994

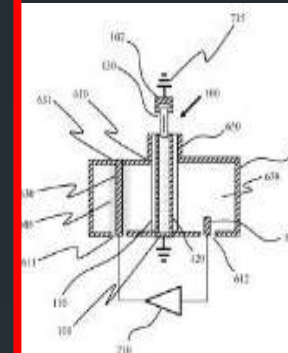
Luxim



陶瓷谐振器的小型等离子体灯

2000

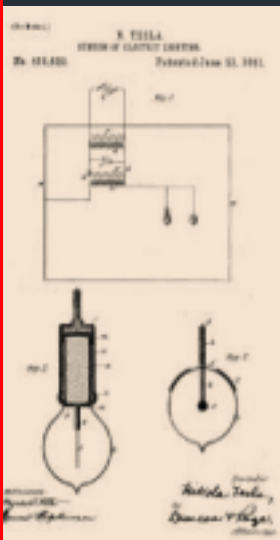
Topanga



紧凑型空气谐振腔的先进等离子体灯 APL

2009

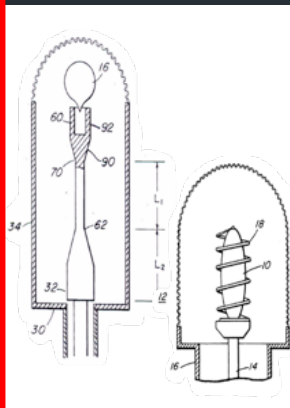
Nikola Tesla



无极灯

1890s

GTE Labs



无电极金属卤化物灯

1975/78

SPL Industries
北京, 宁波

100,000流明
700瓦
专利池技术

超级等离子体灯
SPL

2014-15

凯若维森公司把用于谐振控的陶瓷换成了石英，公司用旋转微波淘汰了旋转灯泡。

现代等离子体照明产品方案

LG

Maltani

Ceravision

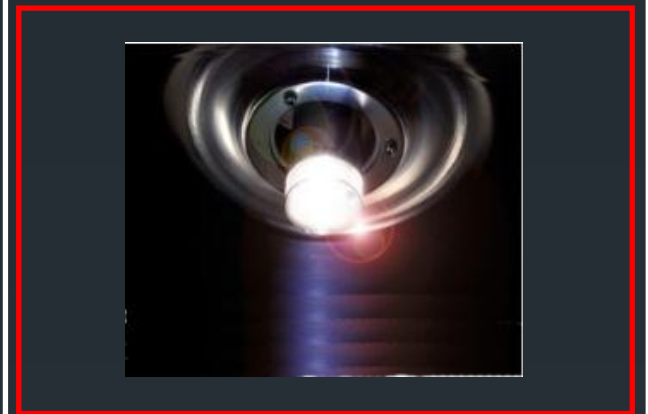


Fusion Light

- 网谐振腔
- 球形灯泡，必须旋转
- 磁控管转换射频电磁场到光能
- 使用磁控管专用电源
- 受磁控管寿命限制（1万小时）
- 数字控制接口
- 空气冷却（风扇）
- 色温：4500-7500K
- 显色指数：85
- 很亮、很重、很大
- 造价昂贵



- 网谐振腔
- 球形灯泡
- 旋转的电磁场，灯泡固定
- 磁控管转换射频电磁场到光能
- 使用磁控管专用电源、
- 受磁控管寿命限制（1万小时）
- 风扇强制的空气冷却
- 高显色指数：95+
- 当前流明范围 70K
- 很重、很大
- 造价昂贵



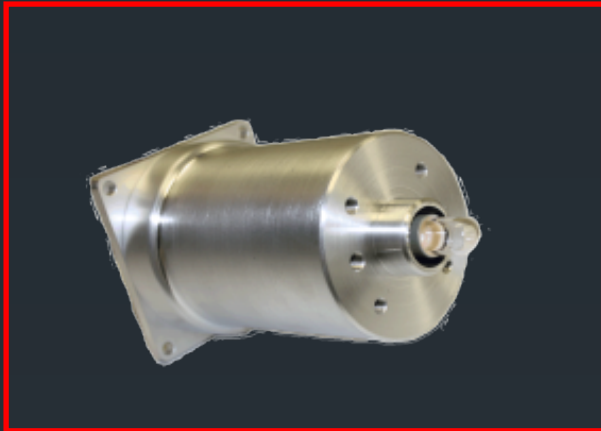
- 金属网围绕石英晶体的谐振器
- 灯泡轴向安装
- 灯泡不可更换
- 金属网直接阻挡光辐射
- 磁控管转换射频电磁场到光能
- 使用磁控管专用电源
- 受磁控管寿命限制（1万小时）
- 数字控制接口（In PS）
- 风扇强制的空气冷却
- 显色指数：相当于95
- 当前流明范围不详
- 尚没有产品
- 与Luxim有专利争议

现代等离子体照明产品方案

Topanga

Luxim

22



APL

- 低成本铝制空气谐振腔
- 灯泡轴向安装，暴露最大的光和热辐射，有利光效和散热
- 灯泡可更换
- 不涉及特殊物质的能量转换
- 固态射频驱动
- 交/直流电源
- 灯泡寿命5万小时，驱动10万小时
- 数字控制接口
- 空气对流冷却
- 工艺与传统机电制造兼容
- 不涉及贵重材料，设备和污染处理



PL

- 金属/陶瓷谐振腔
- 灯泡横置，半埋藏在固态衬底中，不利光效和散热
- 灯泡不可更换
- 三氧化二铝耦合电磁场-光转换
- 固态射频驱动
- 交/直流电源
- 灯泡寿命5万小时，驱动10万小时
- 数字控制接口
- 空气对流冷却
- 重量和体积相当
- 电-光转换率低
- 制造工艺和材料复杂而昂贵

先进等离子体照明与最接近的等离子体光源技术的比较

APL vs. the second best plasma solution

APL 先进等离子体照明

发光体（灯泡）
被完全显露在外



电磁谐振体使用的介质
空气
(铝壳结构的谐振腔)

PL 其他现代等离子体照明

发光体（灯泡）
被半埋藏在
谐振介质中



电磁谐振体使用的介质
(用固态蓝宝石 Al_2O_3 体)
(用固态石英体)
(用固态陶瓷体)

先进等离子体照明 (APL)

- 增加了光照输出，因而取得更高光效，更好散热
- 发光体（灯泡）可以被独立更换
- 免去贵重材料及其制备，大幅度降低了制造复杂性和成本
- 真正“点光源”支持最简捷设计、理想光效应用、最经济和小型化的反射体设计
- 提供更均匀的光照分布和最可控的投影效果

先进等离子体照明APL的差异化优势：光效,节能,低成本和易于制造