

A photograph of the OSRAM building at night. The building features a large glass facade with the OSRAM logo illuminated in orange. The interior lights are visible through the glass, and the sky is dark. The building's architecture is modern with a grid-like structure.

OSRAM

# CoB商店照明的技术发展趋势及应用案例分析

## Technical trend and case study of CoB in shop lighting

陈文成 博士 | 2014-11-20 | OFweek LED Summit 2014 (深圳)

Light is OSRAM

**OSRAM**  
Opto Semiconductors

# 商店照明的目的- 吸引行人到顾客

## Purpose of Shop lighting - passersby into customers

完美的照明将商店橱窗变成一个秀台。吸引路过的行人，确保他们真正步入店内，成为潜在的顾客。”



- 射灯营造完美的照明，吸引人眼球，主要为门店装潢。
- 光束通常为是窄光束，以便与周围环境形成对比。
- 研究表明，对比度比亮度更重要。

CoB商店照明的主要技术挑战:

1. 均匀的窄光束/中心光强
2. 很高的光品质/色彩还原

# 商店照明所用的主要灯具和CoB种类

## Main types of luminaire and CoB in shop lighting

筒灯



- 较宽光束角
- 主要侧重在光效和成本 (lm/w和lm/\$)

射灯



- 较窄光束角
- 更加关注最大中心光强 (cd/W and cd/\$)



SOLERIQ®  
P6



SOLERIQ®  
P9



SOLERIQ®  
P13



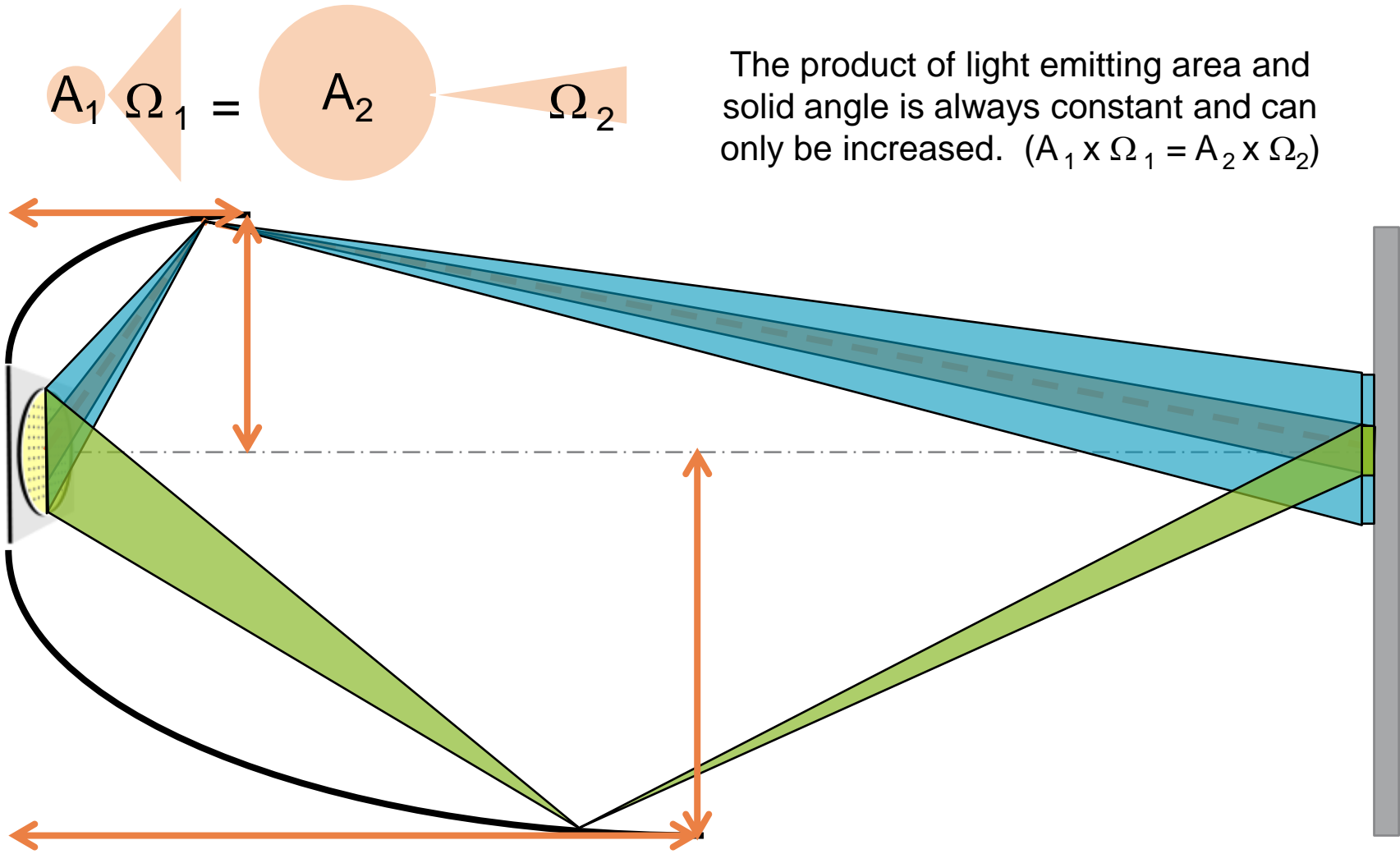
SOLERIQ®  
S13



SOLERIQ®  
S19

# 光学扩展量理论：FWHM，CBCP和LES之间的约束关系

## The law of Etendue: interaction of FWHM, CBCP, LES





# 如何实现更高的中心光强（CPCB）？

## How to achieve higher CPCB?

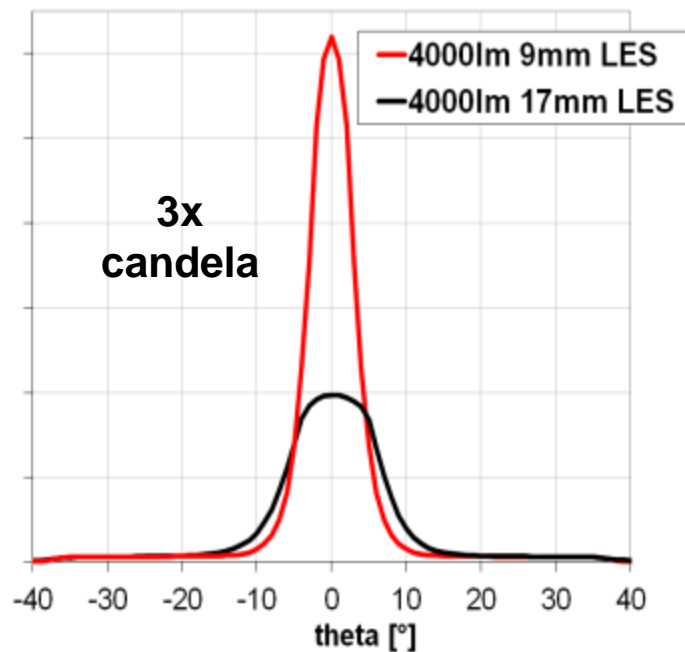
更小的发光面积→相同的半峰全宽(FWHM)和光强，可以实现较小的反光杯设计

更小的发光面积→较窄的半峰全宽(FWHM)，更高的中心发光强度 (CBCP)



发光面(LES) 更小, 聚焦效果更好。

luminous intensity [cd]

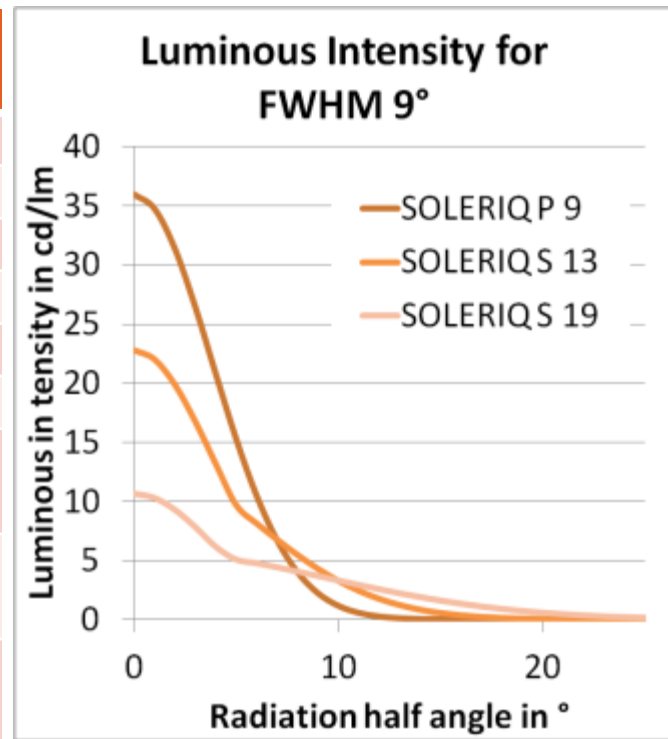


更小的发光面积使发光强度得以增加，并且不会减少半峰全宽→需要相应优化改进反光杯设计

# 模拟设计：不同LES在射灯设计中的比较

## Simulation: LED spotlight design with different LES

	SOLERIQ P 9	SOLERIQ S 13	SOLERIQ S 19	UNIT
Reflector $\varnothing$		110		mm
<b>LES <math>\varnothing</math></b>	<b>9</b>	<b>13</b>	<b>19</b>	<b>mm</b>
FWHM	9	9	9	$^{\circ}$
cd/lm	36	23	11	cd/lm
Lumen	2000	1625	2700	lm
CBCP	72k	37k	29k	cd
Power Consumption	20	17	23	W
Luminous Flux Efficacy	100	98	117	lm/W
<b>Intensity Efficacy</b>	<b>3600</b>	<b>2200</b>	<b>1260</b>	<b>cd/W</b>



在采用相同尺寸的反光杯，实现相同的半宽度角的情况下，由于不同的LES，会得到不同的最大中心光强。LES越小，中心光强越强。对于窄光束射灯，光凭FWHM值并不能准确的描述配光情况，光凭配光曲线也并不能全面评价光斑的好坏。

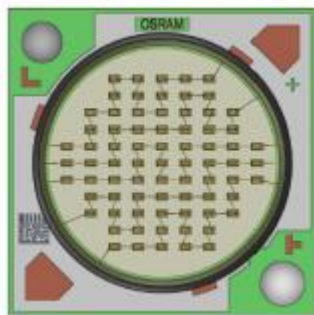
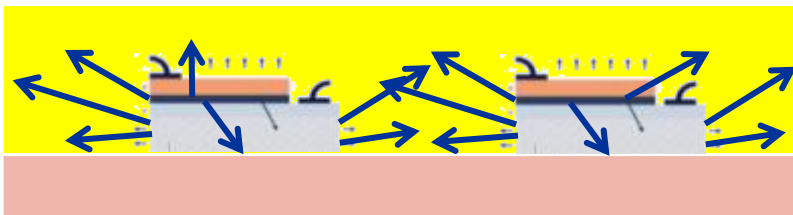
# 不同芯片技术对CoB LED的影响

## Influence of chip technology on LES of CoBs?

为何我们不能简单的把芯片跟芯片紧密排在一起？

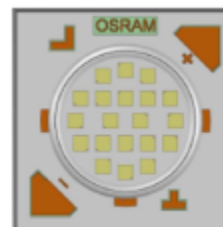
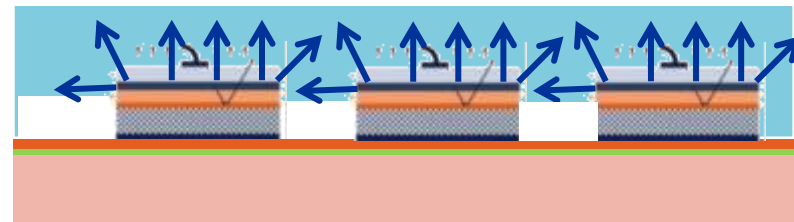
1. 芯片之间相互吸光的影响
2. 散热的影响
3. 生产工艺的影响

Volume-emitter CoB



chip area usage:  
~25%

Surface-emitter CoB

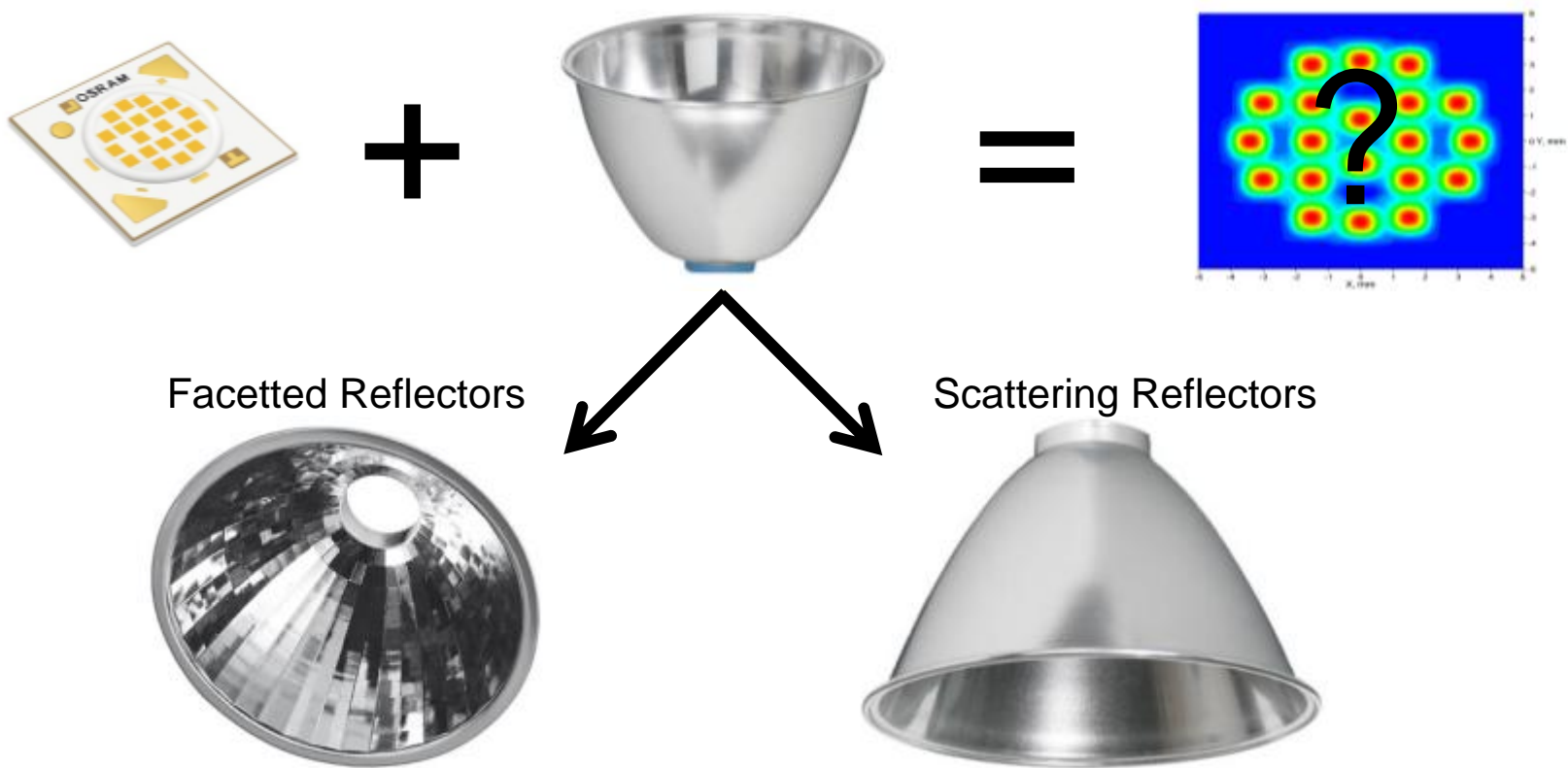


chip area usage:  
30%~50%

# 窄光束反光杯设计的挑战

## Challenge of narrow angle reflector design

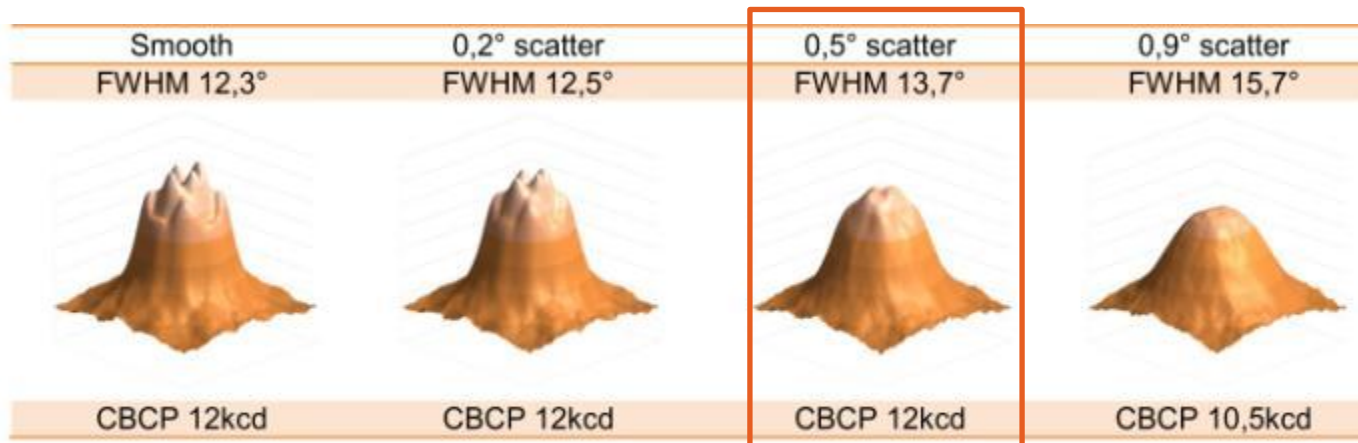
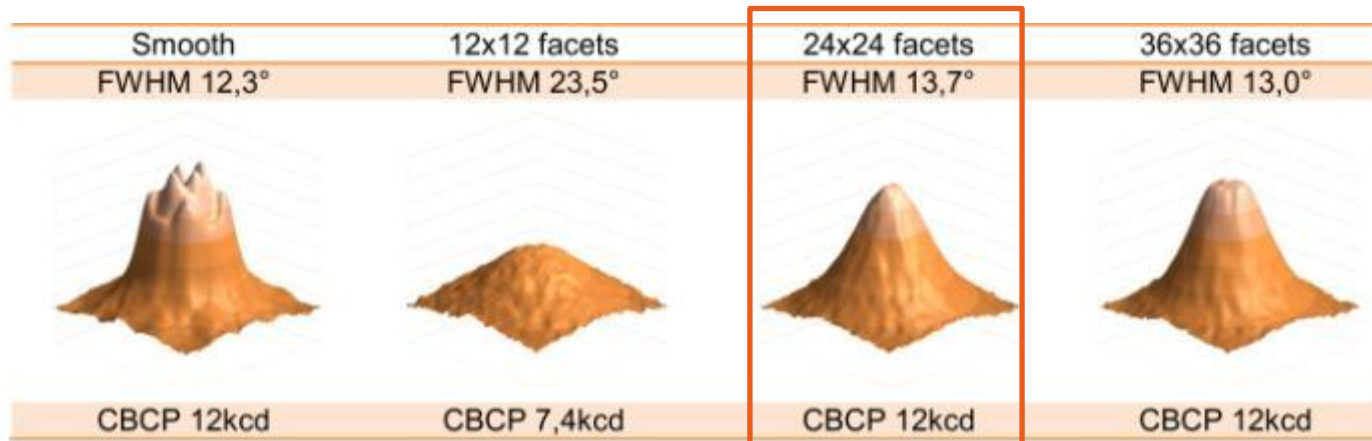
当采用大功率LED芯片实现紧凑LES时，在反光杯设计上可能还会遇到些挑战





# 采用多楞面和磨砂的方式改善光斑效果

## Improve light mixing by facets or scatter

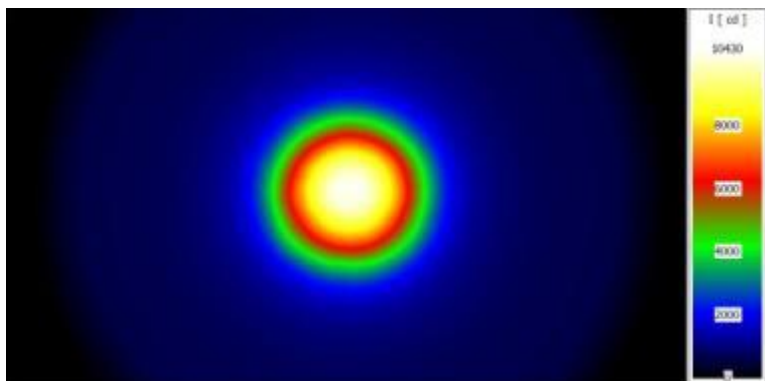


采用多楞面和磨砂的方式可以改善光斑效果，但需要在混光效果和中心光强间找到合理平衡点。

## 多楞面反光杯的实际效果

### Example of real spotlight optics with facets

采用合理设计的多楞面反光杯可以在SOLERIQ P9上实现均匀的窄角度光斑

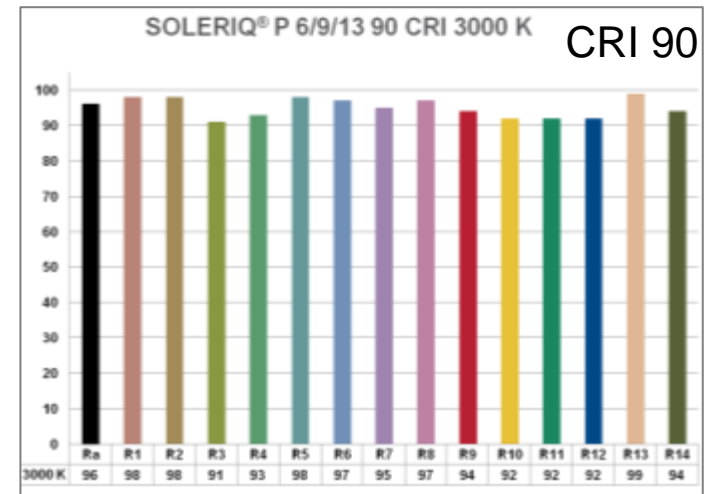
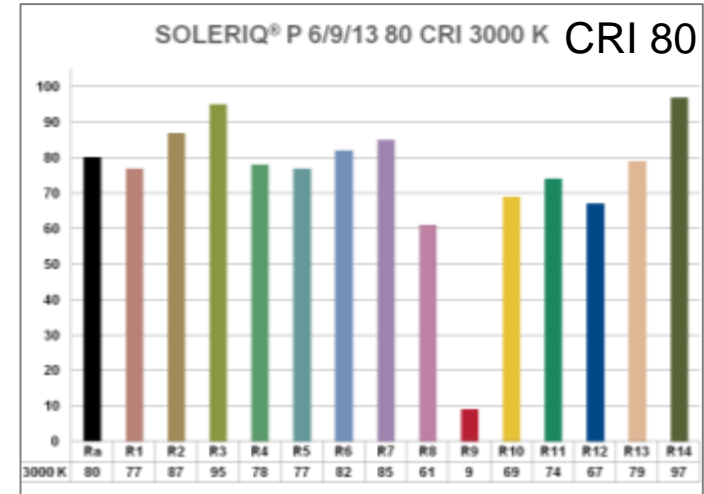


除了反光杯外，针对P6，P9等较小LES的CoB，也可以采用透镜的方式。

# CoB能否实现高的显色指数CRI?

## Can CoB achieve high CRI?

Light Source	Metal Halide Lamp CRI 91	High CRI LED CRI 96
Spectral Power Distribution		
Test Colour Samples		
Lab		



# 评价显色效果的不同指标

## Different metrics for color rendering

The results confirm the outcome of the booth experiments:  
the Qp, Qg and FCI metrics correspond best to the visual observations.



	CCT[K]	Duv	Ra	R9	CQS v7.5	CQS v9.2	Qp v7.5	Qg v7.5	FCI
LED SPD1	4089	-0.0042	79	56	84	83	98	117	145
LED SPD2	4089	0.0036	80	58	86	87	97	113	141
LED SPD3	4026	-0.0033	82	48	86	85	96	111	132
FL 4000 K	3800	0.0047	81	7	80	81	80	96	105

colour rendering index (**Ra**), colour quality scale (**CQS**),  
colour preference scale (**Qp**), feeling of contrast index (**FCI**)

Resource: SSL4EU Newsletter #5 July 2013

# 显色和显白对于商店照明同样重要

## Trends towards different “white light”

商店照明中除了对彩色物体的还原性外，对白色物体的还原性也同样重要！

对彩色物体的还原性

对白色物体的还原性

High CRI  
White

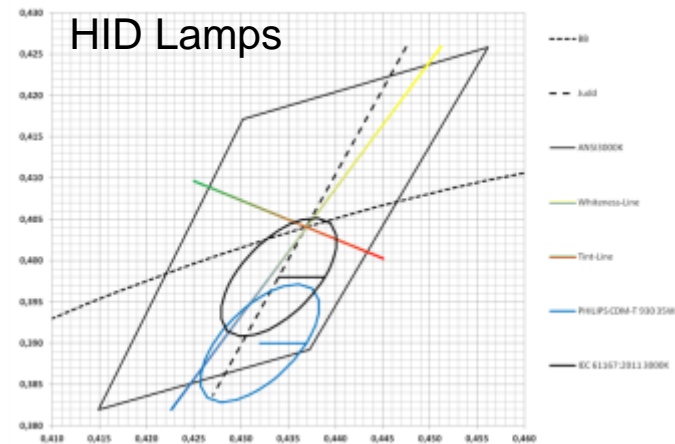
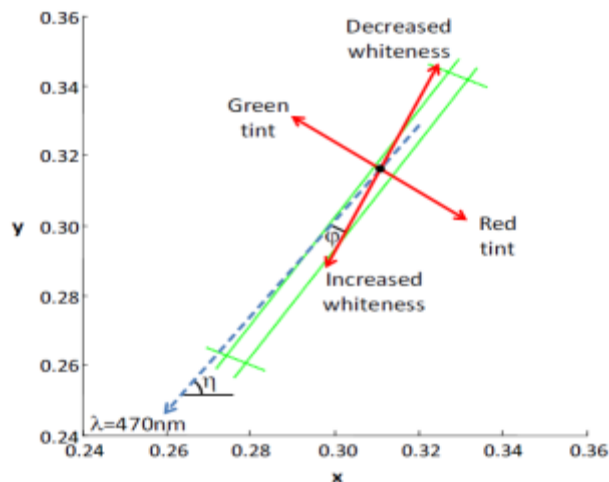
Custom  
White

Brilliant  
White

Below Black  
Body White

Crisp White

New CMF  
White

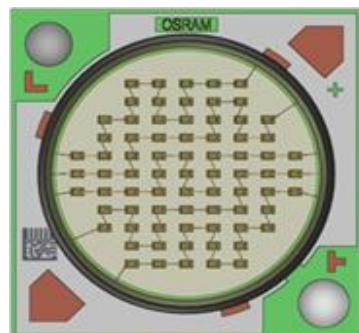
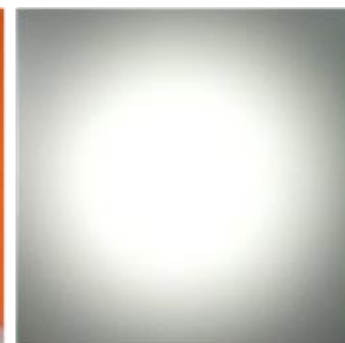
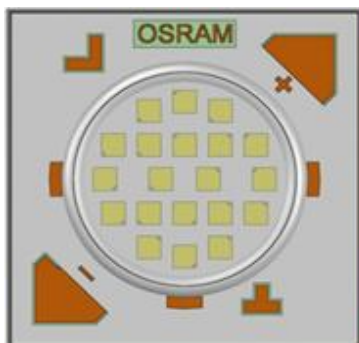




# P9 和 S19 在射灯设计中的实例分析

## Case study of P9 and S19 in spot light design

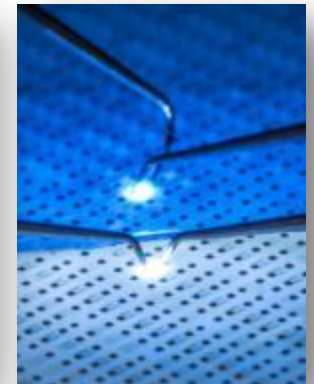
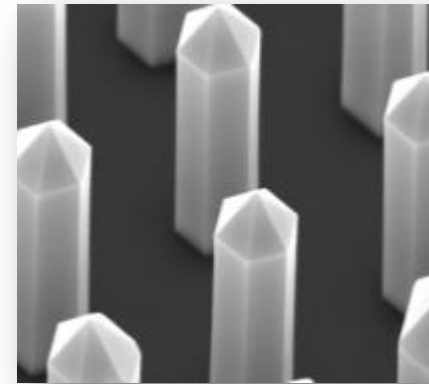
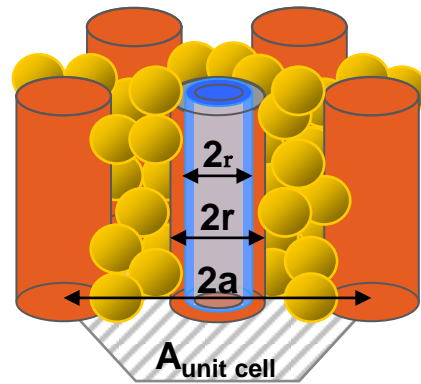
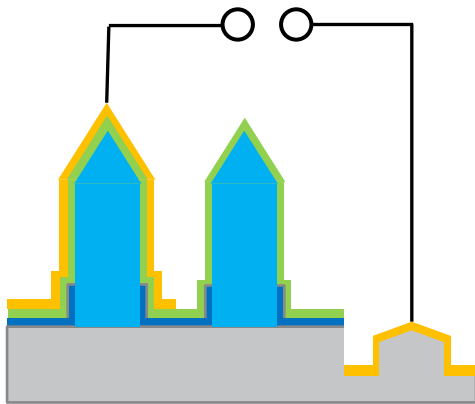
Ref. Design	LED type	Flux (lm)	Reflector (FWHM and size)	Flux (lm)	Power (W)	Efficacy (lm/w)	CBCP (cd)	FWHM
Track Spot light	SOLERIQ P 9	2000 lm	NATA 12° D=75mm,H=43mm	1564 lm	23.1 W	67.7 lm/w	17157 cd	12.2°
Ceiling spot light	SOLERIQ S 19	2500 lm	Kingesion 15° D=111mm, H=55mm	1812 lm	68.4 lm/w	14893 cd	14.2°	



# 未来趋势：3D纳米白光LED, 实现更高效率和表面亮度

## A future trend to higher efficacy and higher luminance

A future trend to higher efficacy and lower cost for SSL LEDs:  
core-shell InGaN/GaN microrod LED structures



GECCO - phosphor converted white light  
core shell micro rod LEDs



[www.gecco.tu-bs.de](http://www.gecco.tu-bs.de)



**OSRAM**  
Opto Semiconductors



**pfi**  
Paul-Drude-Institut  
für Festkörperelektronik



**Many Thanks.**

