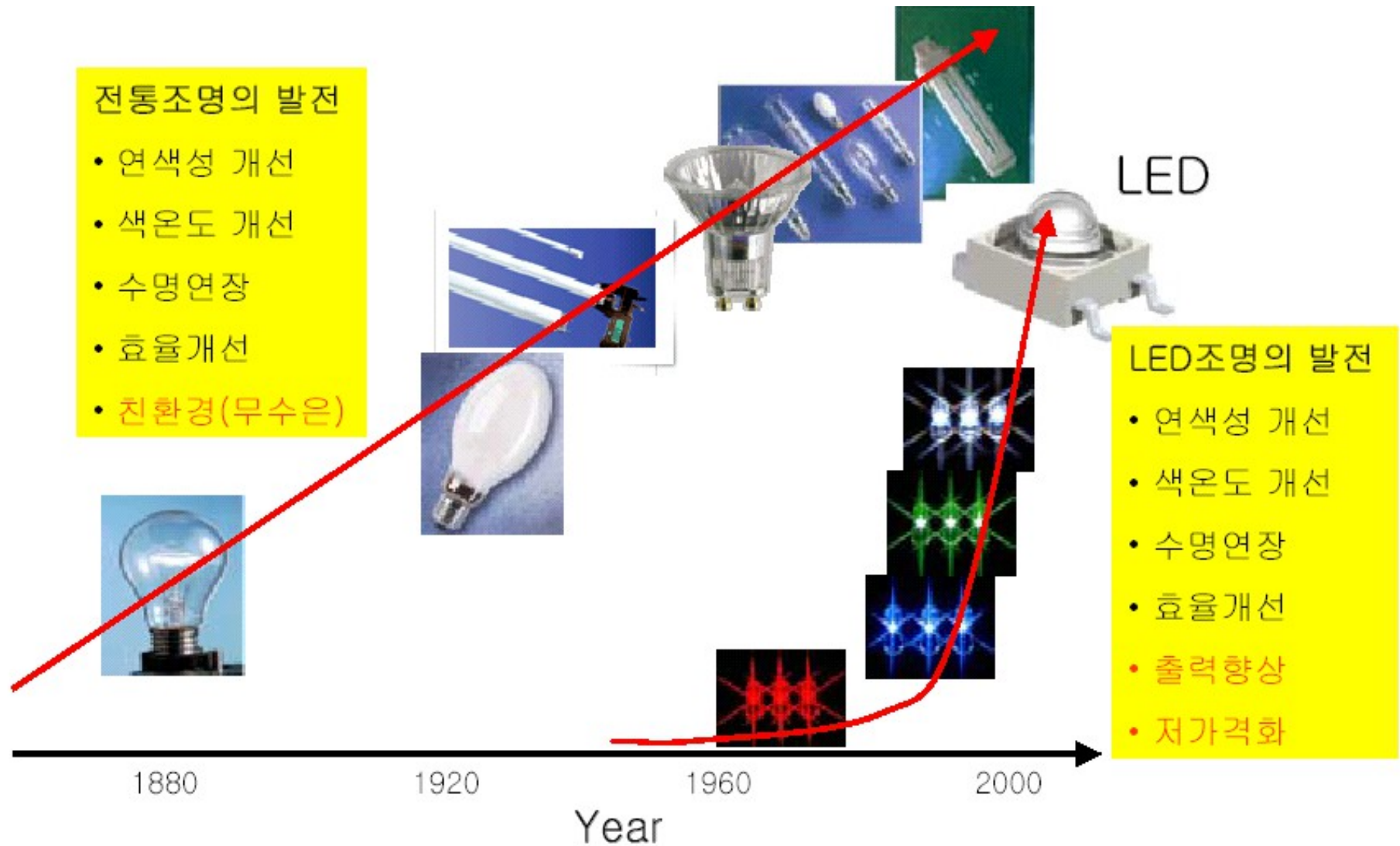


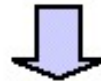


TCC ADHESIVE TEAM

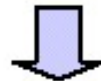




등잔불/촛불 : Chemically fueled black body emission



백열등 : Electrically fueled black body emission

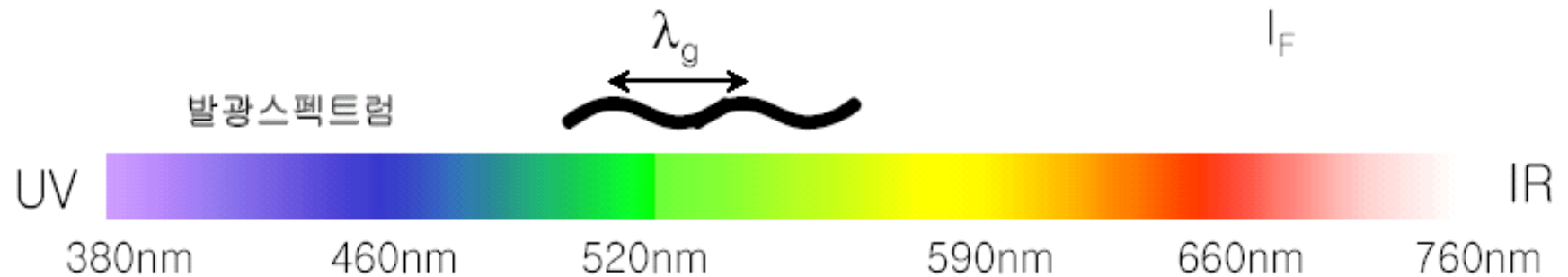
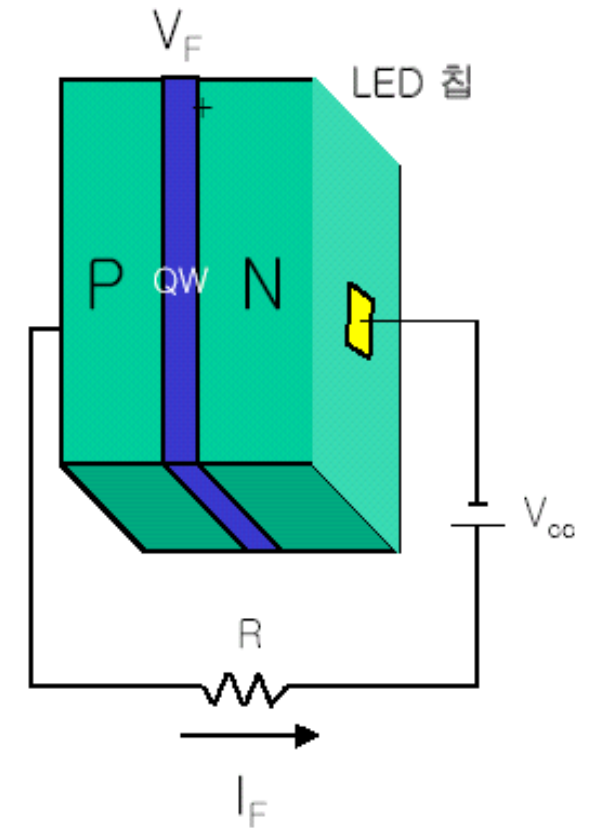
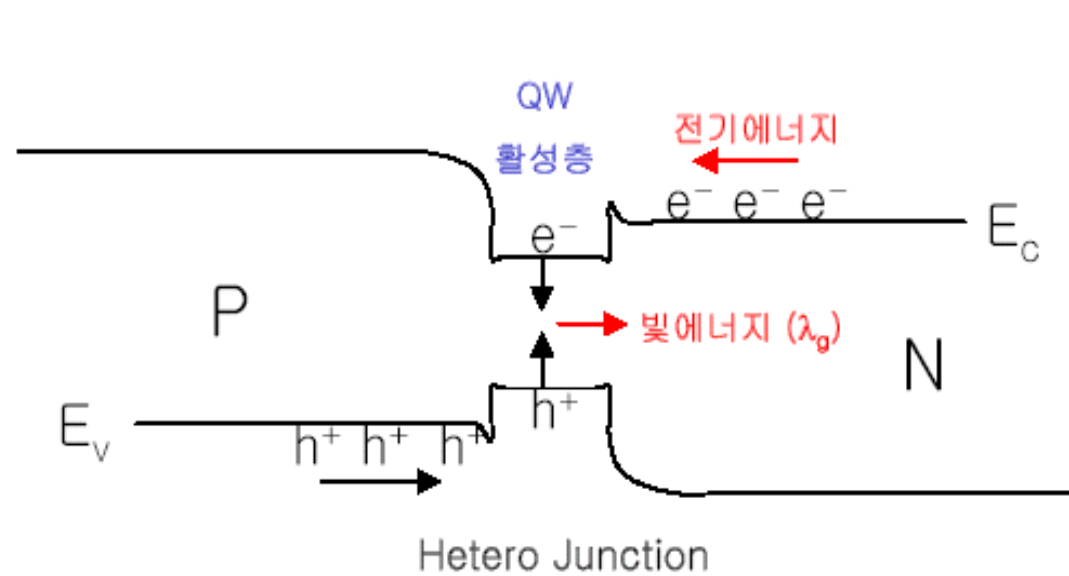


형광등/가스방전등 : Electrically fueled narrow band emission from gases



Solid state lighting : Electrically fueled narrow band emission from solids

LED, OLED, LD, 고체레이저

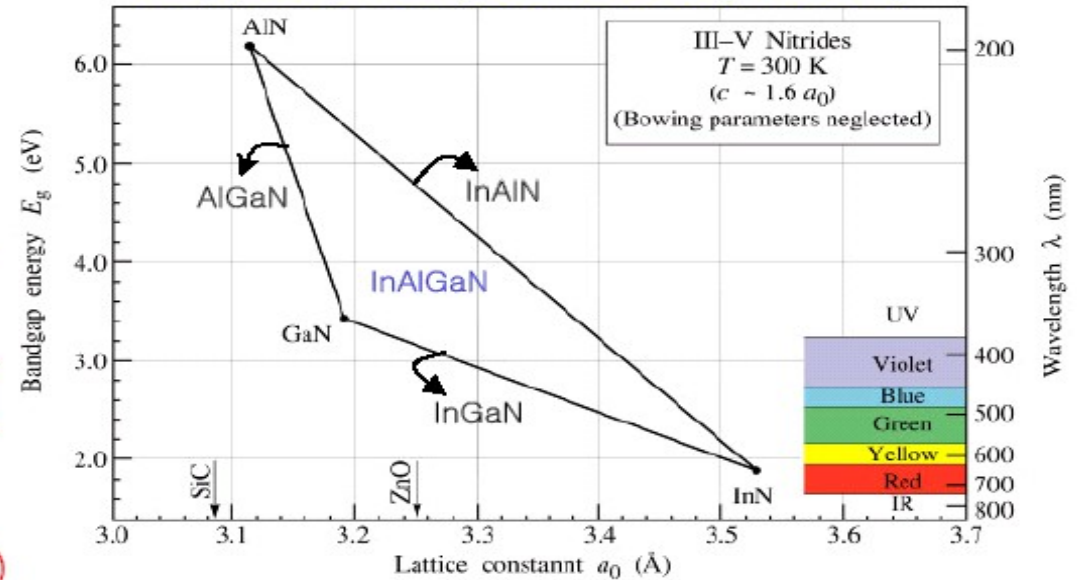


LED 재료

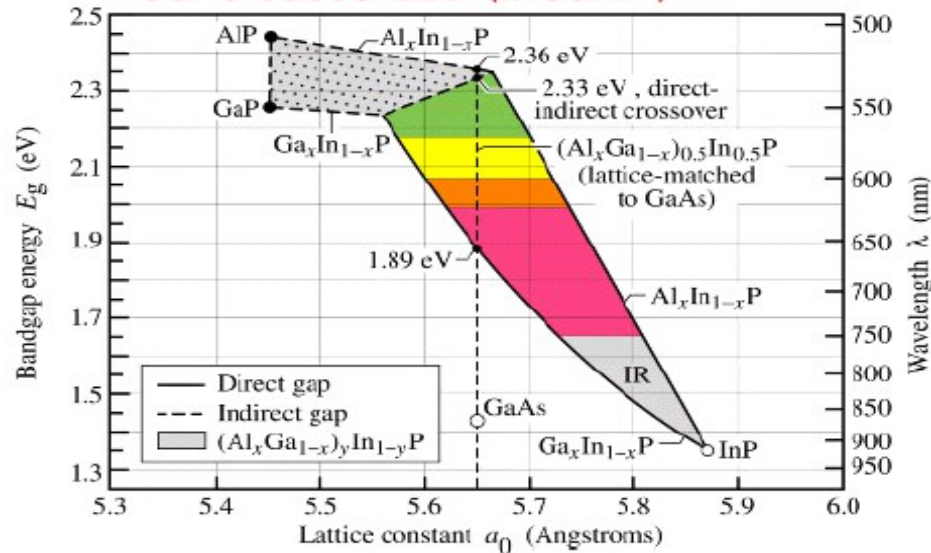
UV/Blue/Green

Yellow/Orange/Red/IR

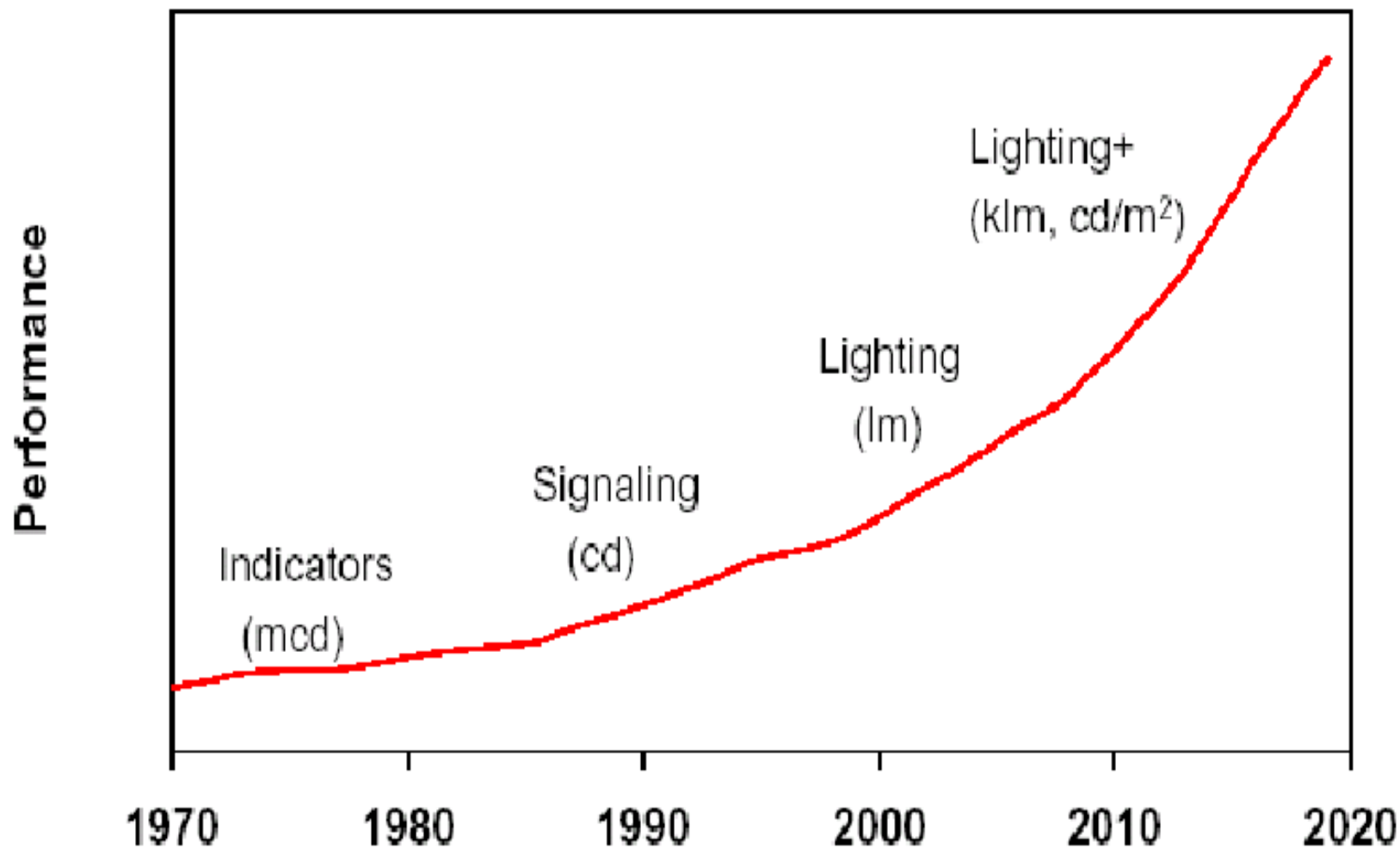
Sapphire(or SiC) based LED (InGaAlN)



GaAs based LED (InGaAlP)



용 어	단 위	의 미
광(선)속 (Luminous flux)	lm (루멘)	광원으로부터 나오는 광의 총량 * 시감도. $1 \text{ lm} = 1/683 \text{ W @ } 555 \text{ nm}$
광 도 (Luminous intensity)	cd (칸델라)	단위입체각당 광속 (lm/sr). <i>진동수 540×10^{12} 헤르츠인 단색광을 방출하는 광원의 복사도가 어떤 주어진 방향으로 매 스테라디안 당 $1/683 \text{ W}$ 일때 이 방향에 대한 광도</i>
조(명)도 (Illuminance)	lx (룩스)	빛이 비춰지는 면의 단위면적당 광속 $1 \text{ lx} = 1 \text{ lm/m}^2$ (직사광 지면위 : 10만 룩스, 보름달 지면위 0.2 룩스)
휘 도 (Brightness, Luminance)	nt(니트) (cd/m ²)	단위 입체각당, 단위면적에서 조사되는 광속 양초 : 1 nt, 달의면 : 0.3 nt, 태양 160k nt
조명효율 (Luminous efficiency)	lm/W	소비전력당 광속



기술적 측면

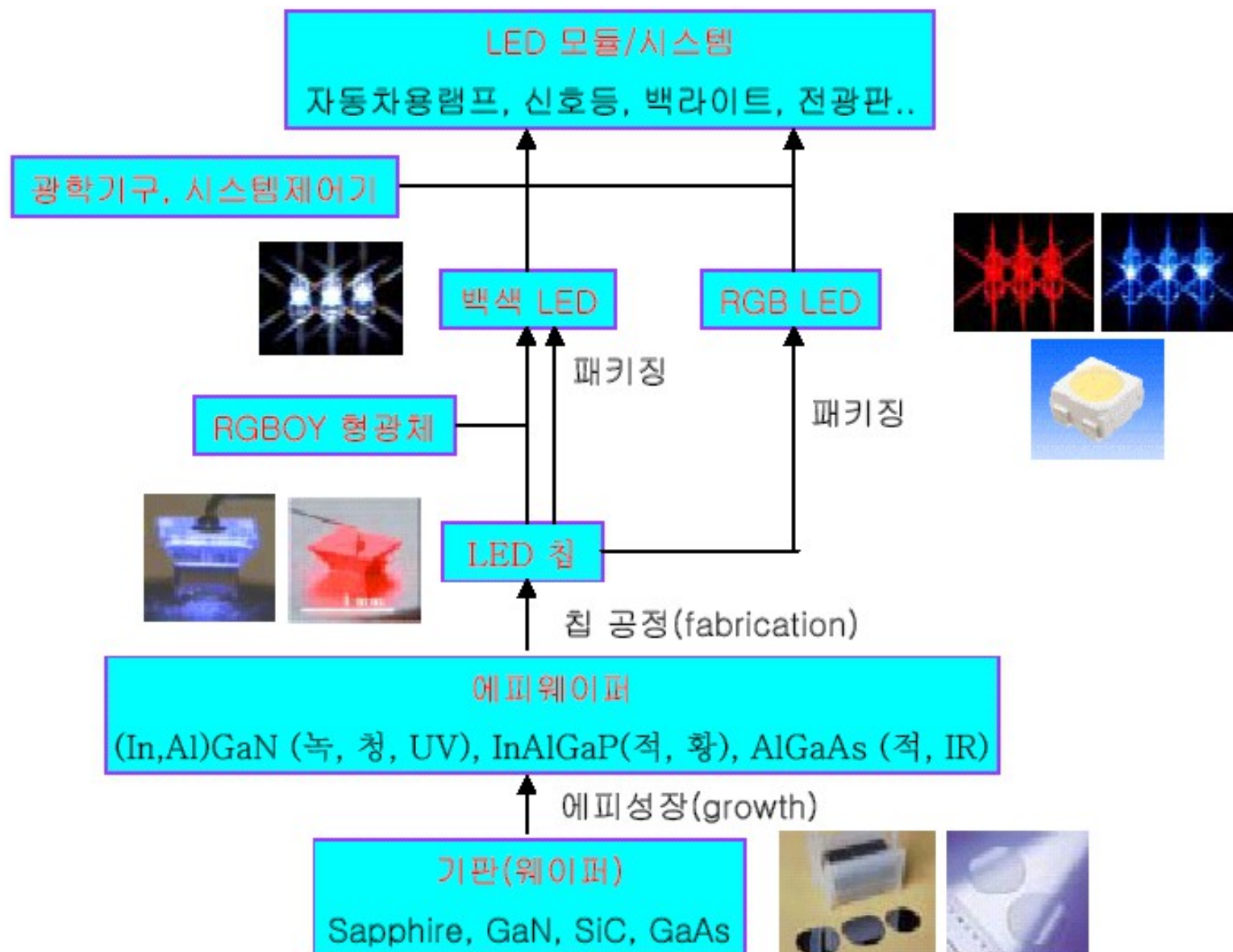
- 저전력, 장수명, 고효율, 소형, 고속응답
- 온도에 민감
- 구동회로의 복잡성

산업적 측면

- 전방위 산업에 응용 (자동차, 휴대용 가전, LCD 모니터..)
- 친환경 산업/고성장 산업
- 높은 초기 구매가격

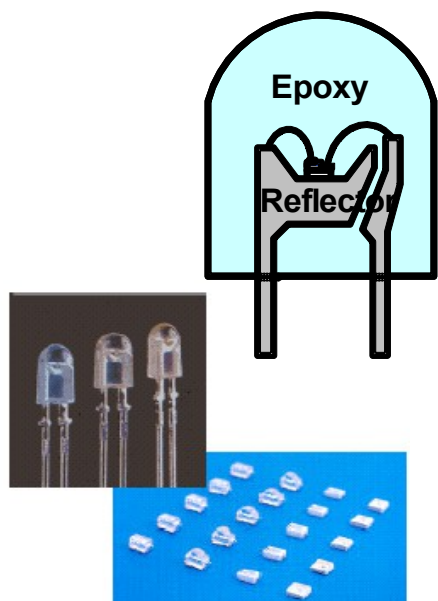
환경/정책적 측면

- 에너지 절감 및 친환경 정책에 의한 대체광원 후보
- 선진국에서는 대형 국책사업으로 LED 조명기술 개발 중
- 국내 생산기술 기반 및 지원은 상대적으로 취약
- 중국/대만의 저가공세, 미국/일본의 기술 및 특허동맹
- 표준화경쟁



과거

**THT package : lamp type LED
(through-hole technology)**

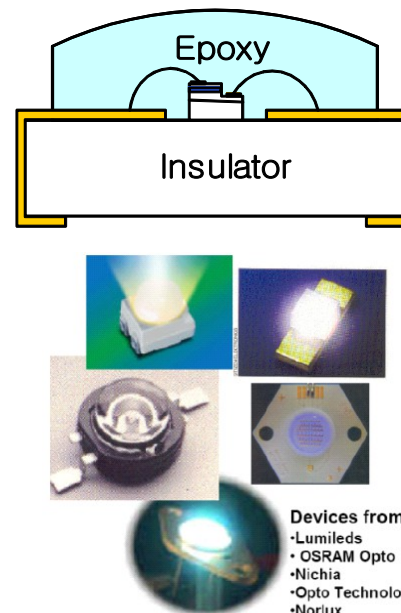
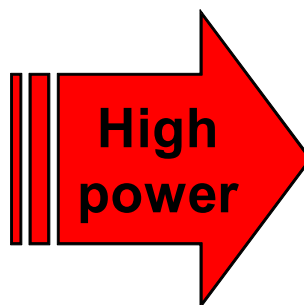


용도 : Indicator LEDs (지시용, 표시용)

- 3mm, 5mm, SMD
- 광도의 낮은 효율
- 매우 낮은 광속
- 높은 가격 저하율

현재

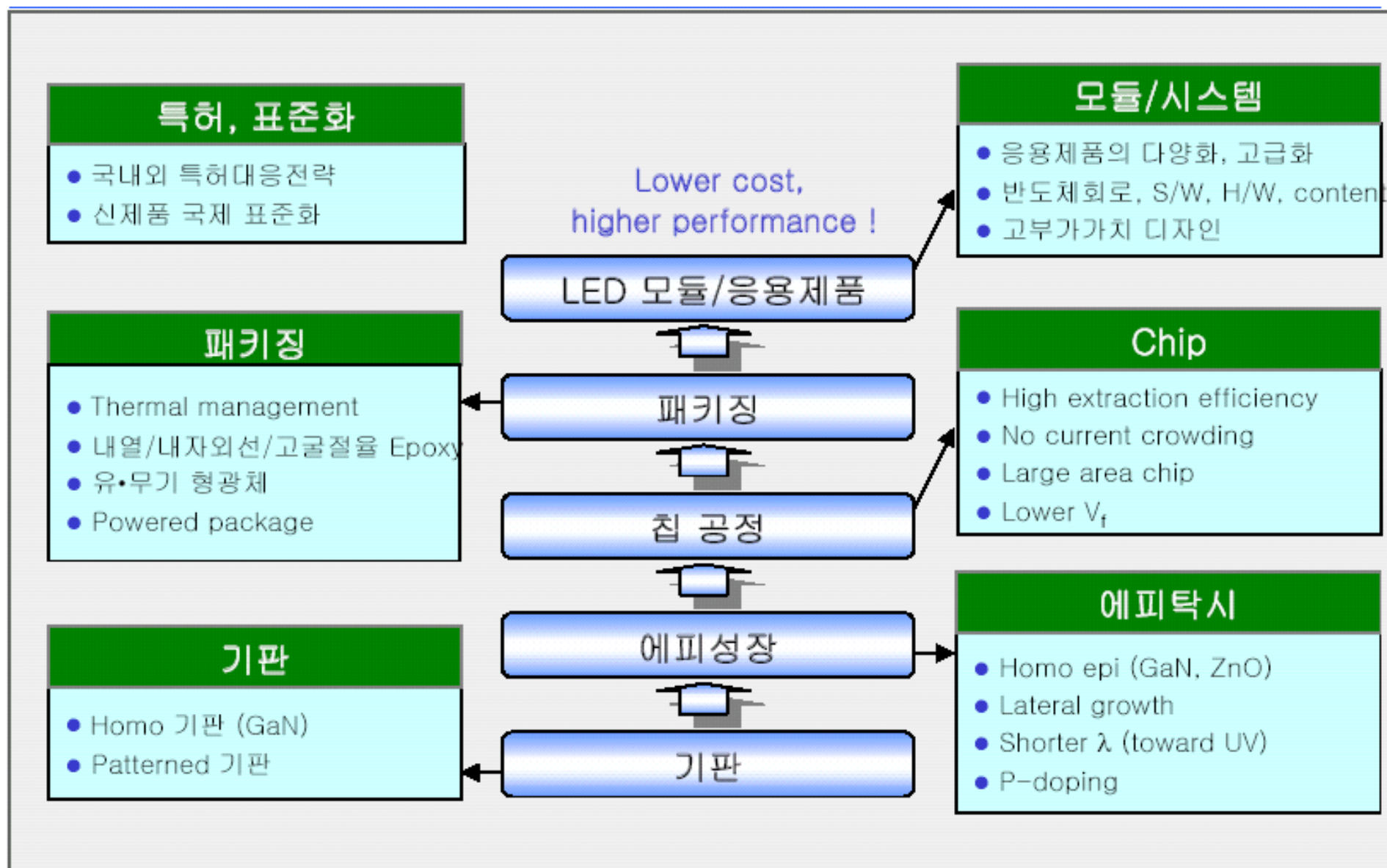
**Advanced SMT package : SMD-type LED
(surface-mount technology)**



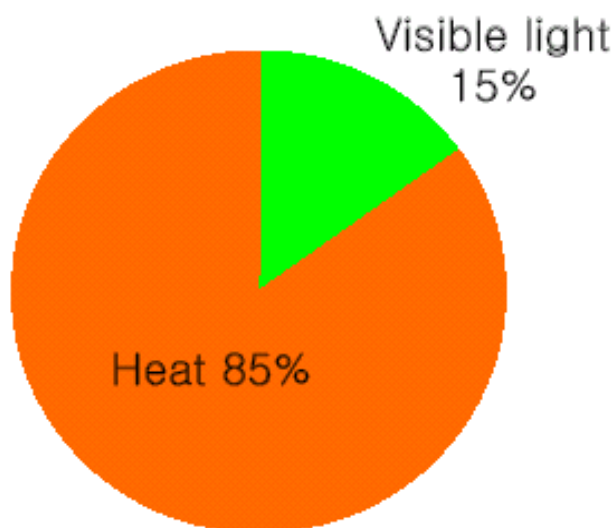
Devices from:
• Lumileds
• OSRAM Opto
• Nichia
• Opto Technology Inc
• Norlux

용도: Illuminator LEDs (조명용)

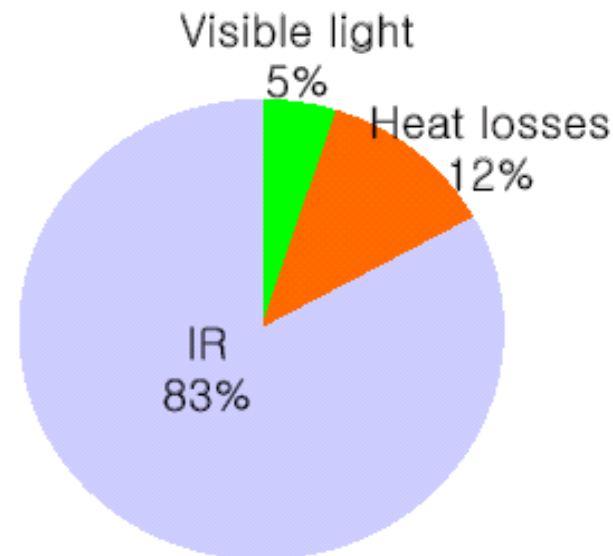
- Advanced SMD
- 광효율 증대
- High-power drive
- 보다 우수한 열관리
- 보다 우수한 광속유지



LED Energy



100 W 백열전구



- LED electronic driver efficiency around 85%
- 15 % of available power in LED's converts to light
- 100W system means 87W of heat
- Thermal management is extremely important

- 빛의 삼원색 혼합

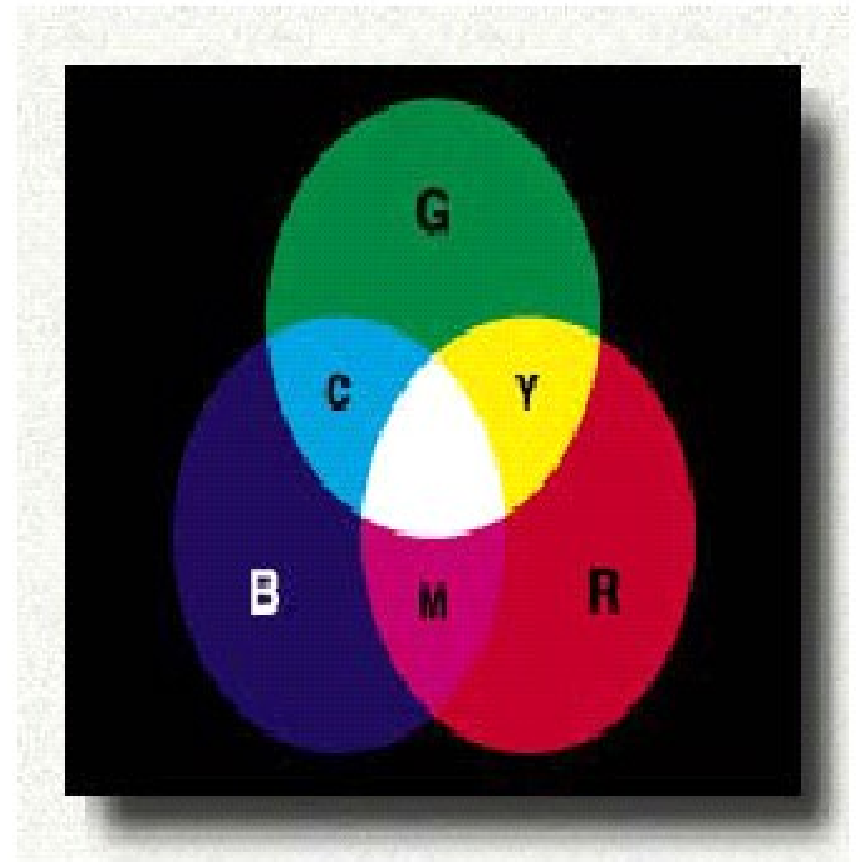
Red + Green + Blue = White

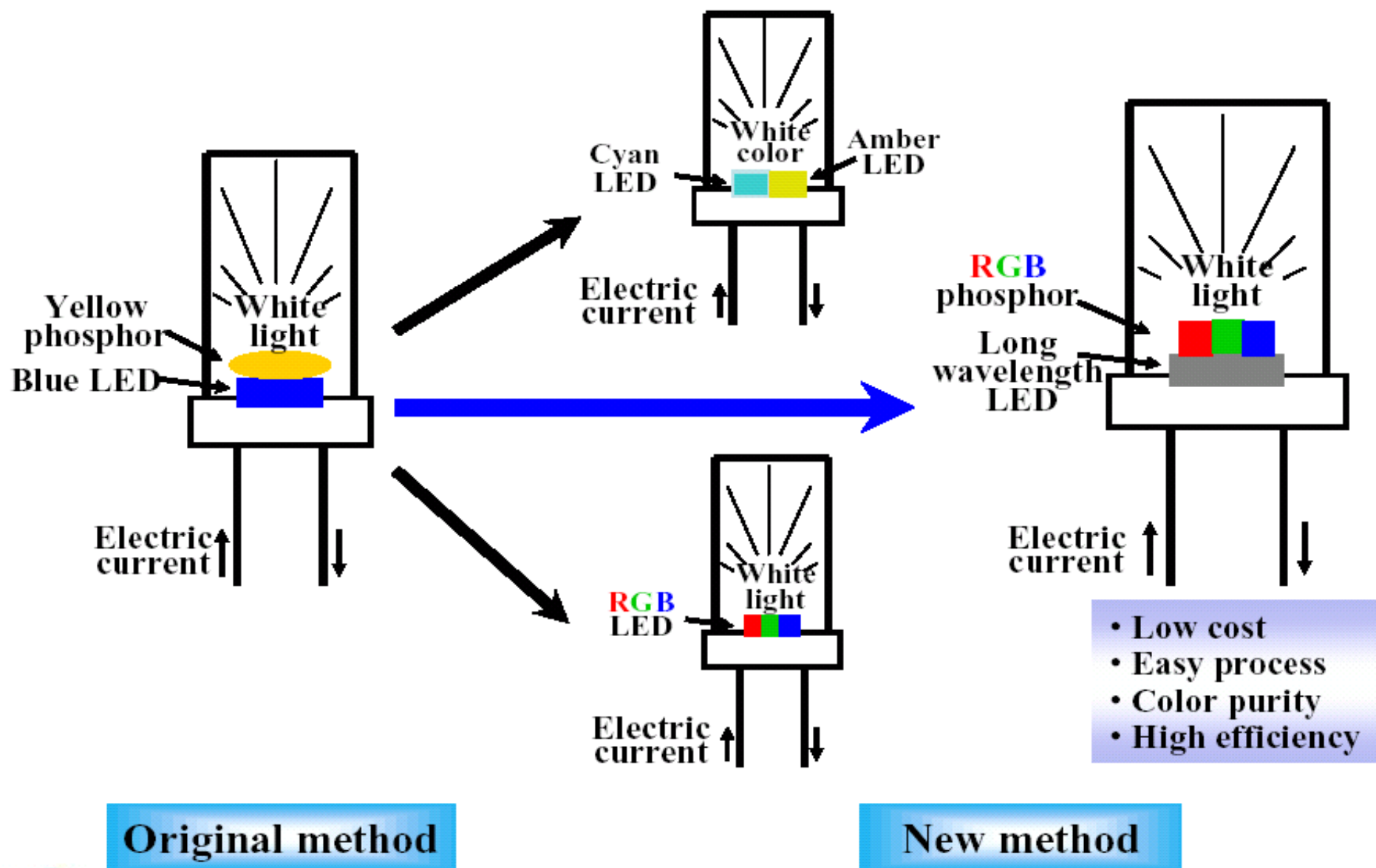
- 보색 혼합

Blue + Yellow = White

Cyan + Amber = White

Green + Magenta = White



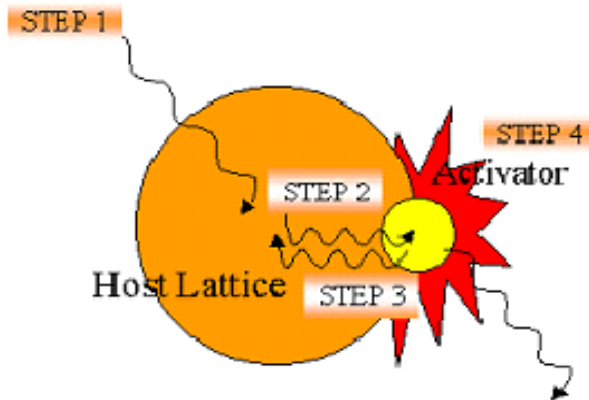


White LED 종류별 특성비교

	1-chip solution		2-chip solution	3-chip solution
	Blue LED + Yellow Phosphor	UV LED + RGB phosphor	Binary Complementary	RGB Multichip
연색성	Δ	◎	Δ	○
색안정성	○	◎	Δ	Δ
수명	Δ	unproven	○	○
효율	Δ	◎	○	○
형광체	양산중	양산중	필요없음	필요없음
특징	제조용이, 색상 균일성 떨어짐	좋은 연색성, 패키지 재료의 내 자외선 요구	좋은 출력, 연색성 떨어짐	좋은 색 연출성, 좋은 출력 신뢰성 떨어짐
응용	백라이트	조명	Task light	전광판

형광체란 무엇인가?

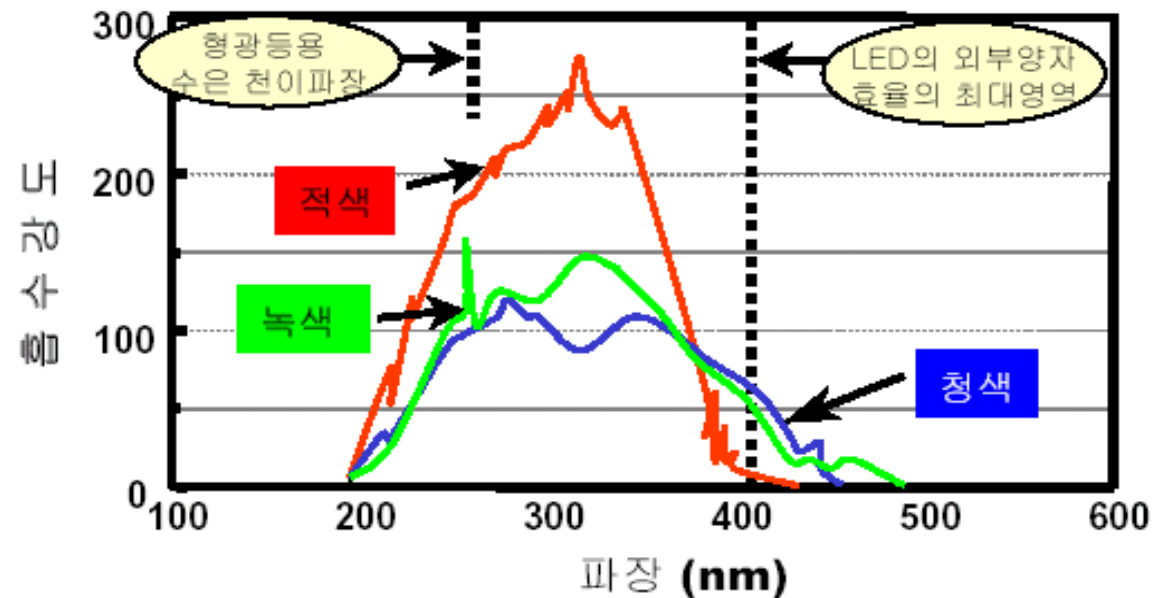
형광체: 자신보다 높은 광에너지 자극에 의해 고유의 빛을 방출.




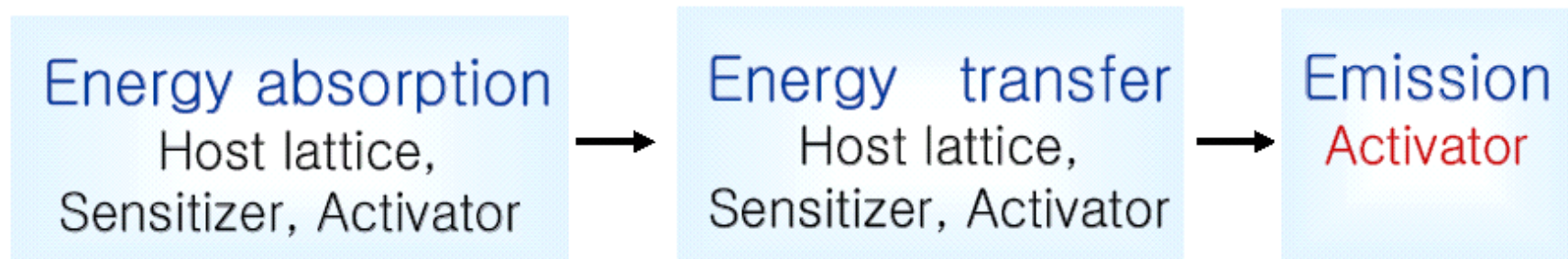
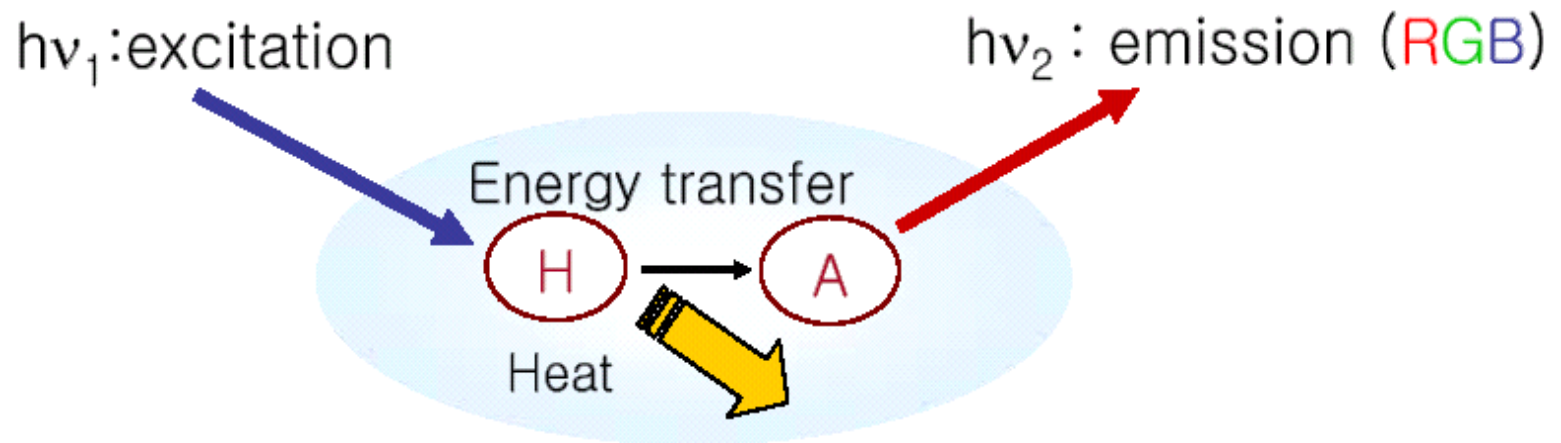
- Step 1 : Absorption
- Step 2 : Excitation
- Step 3 : Relaxation
- Step 4 : Emission

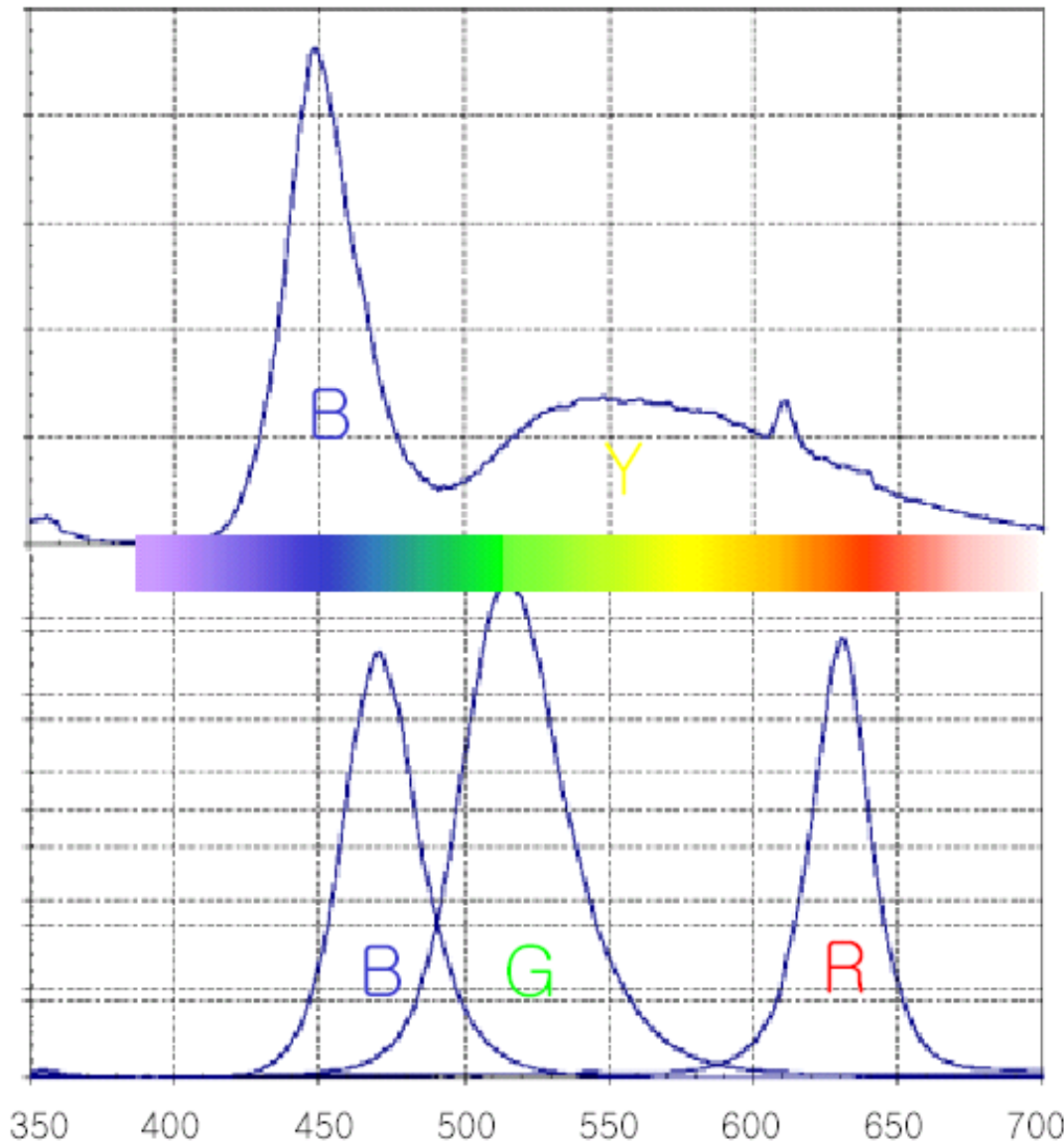
주요 특성

- LED 파장에서의 흡수강도
- 형광체에 의한 2차 산란 빛의 투과도
- 내열성
- 수명



- Phosphor (Luminescent materials); $Y_2O_3:Eu$, YAG:Ce
 host, activator and sensitizer(or co-activator)

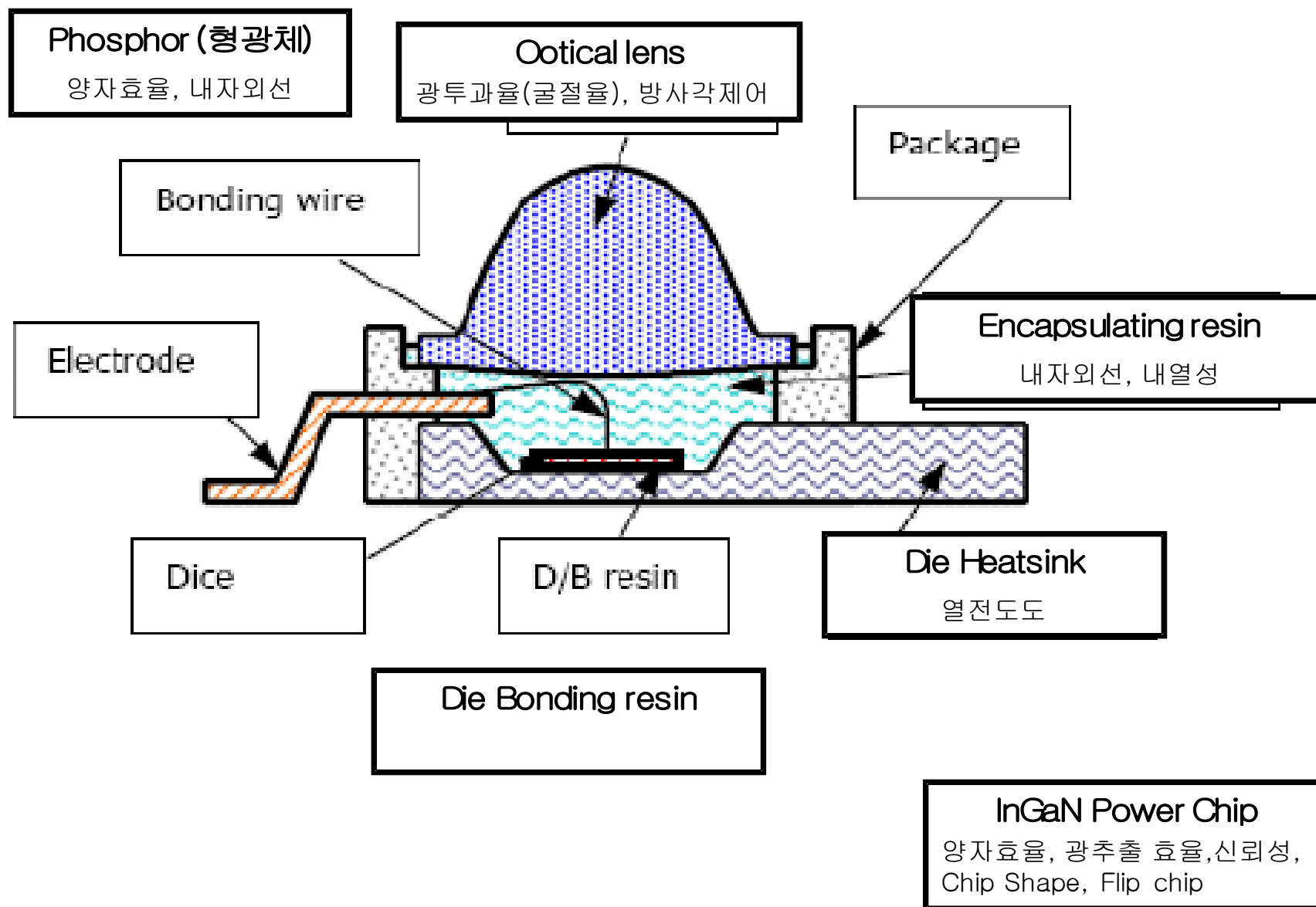




Blue LED + Yellow 형광체

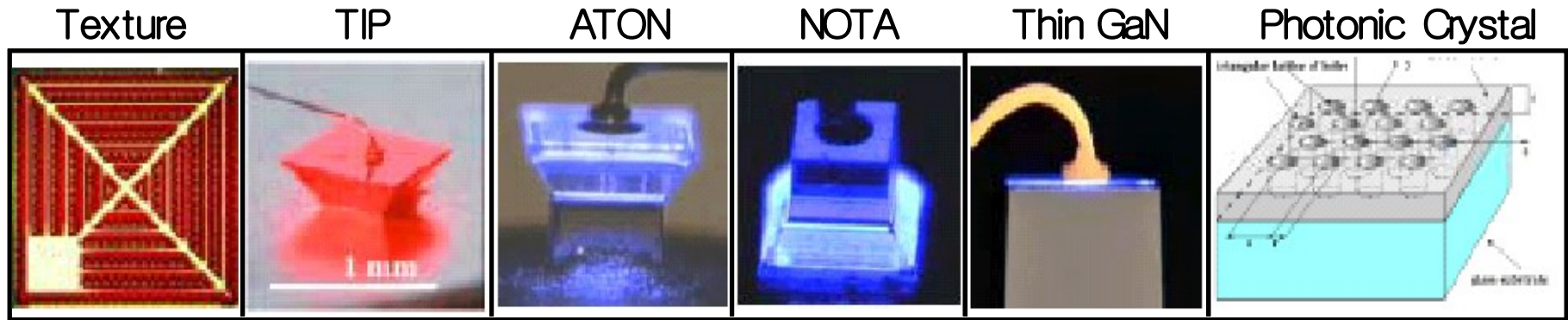
RGB multi chips

High-Power LED Package Issue



1. 광 추출효율 향상기술

① Shaped chip ② Flip chip

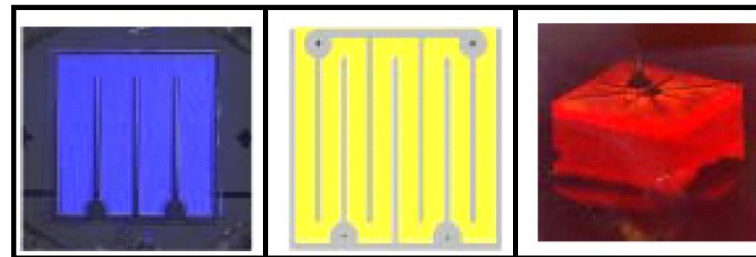


2. P층 Hole spreading (current crowding)

① 비금속 투명전극(ITO, IZO) ② Contact design

3. 대면적 Chip ($> 1 \times 1 \text{mm}^2$)

① Finger 형 전극
② Multiple parallel cell

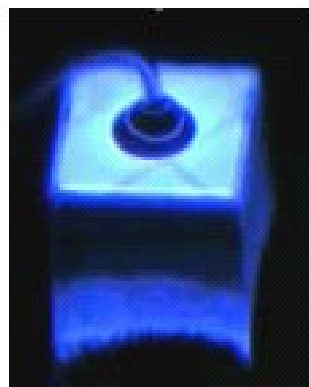
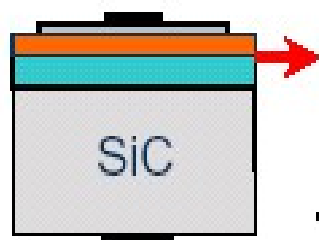


Top-top

Top-top

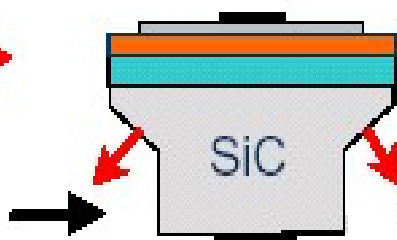
Top-bottom

Standard



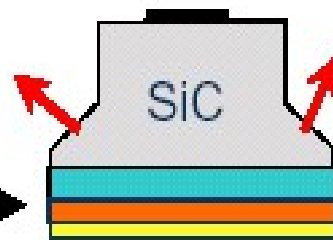
$$\eta_{\text{extract.}} = 25\%$$

ATON



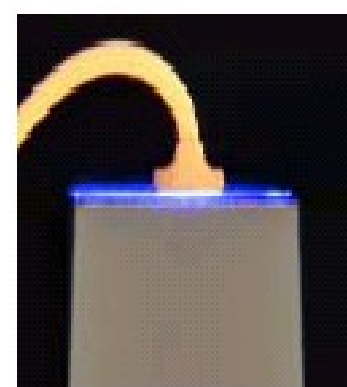
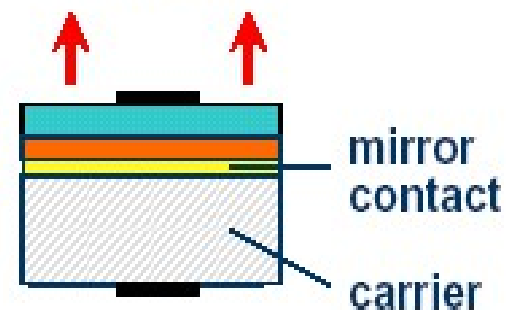
52%

NOTA



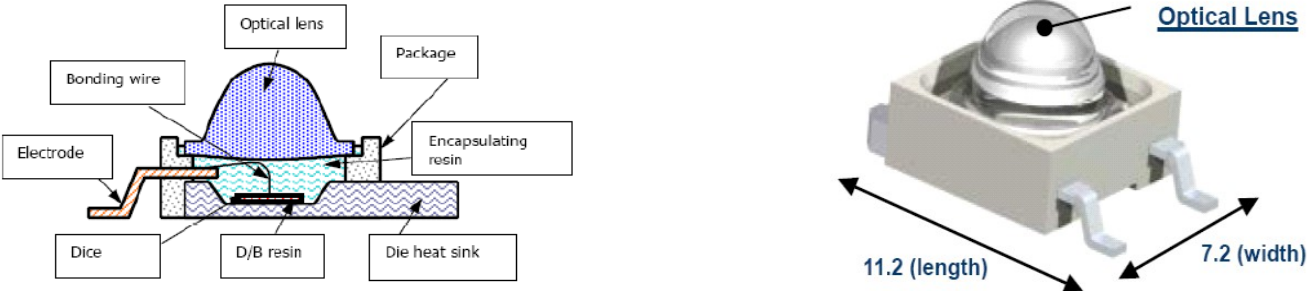


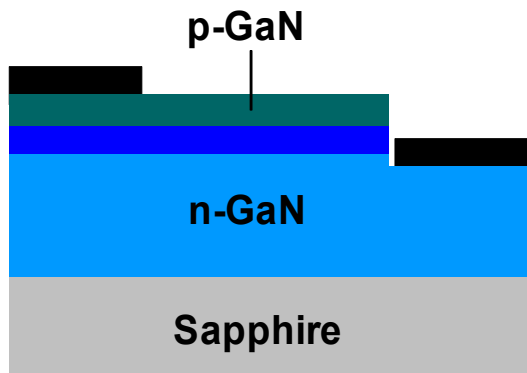
60%

ThinGaN



75%

Company	Package 구조
<p>Luxeon (Lumileds ㄸ)</p>	
<p>Side-Emitter (Lumileds ㄸ)</p>	
<p>Jupiter (Nichia)</p>	



일반 LED type

