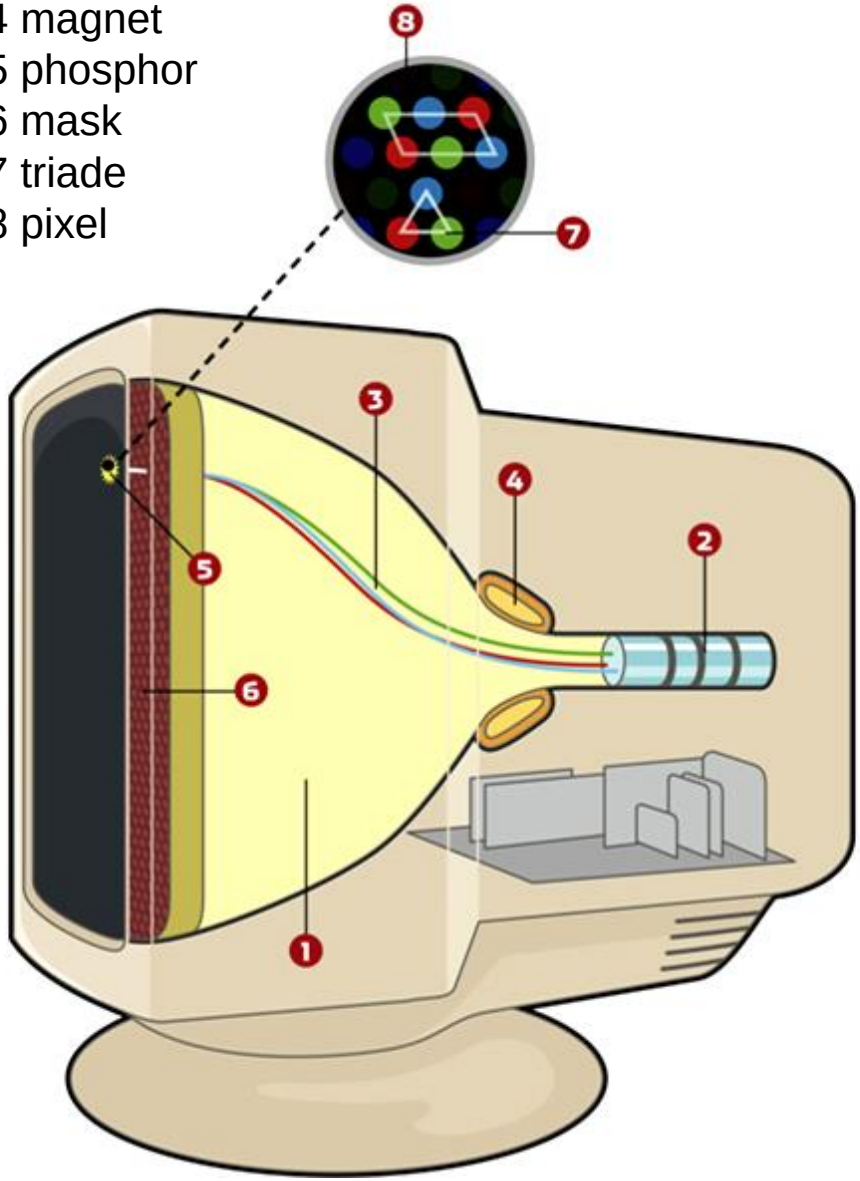
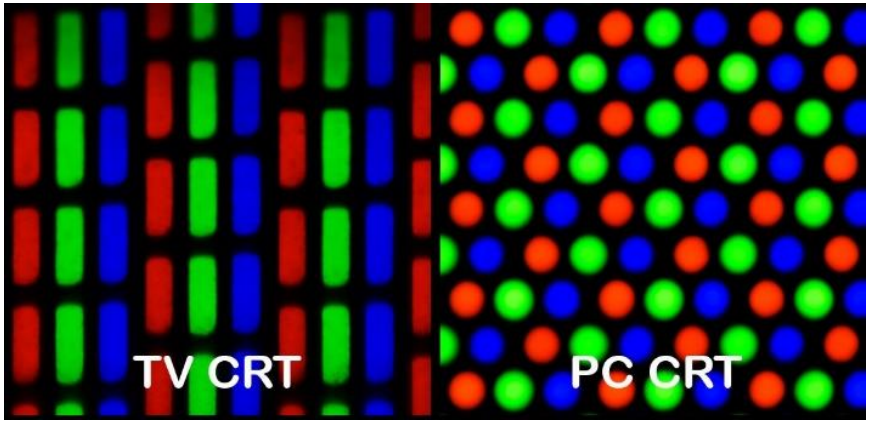

VIERA
dysplays
Panasonic

Cathode **R**ay **T**ube

1 glass lamp
2 electron gun
3 electron beam
4 magnet
5 phosphor
6 mask
7 triade
8 pixel





- kathode : **W, Re** (+ BaO, SrO)
- three guns – RGB
- pixel ~0,2 mm

phosphor – **ZnS** (monochrom)
- **Y2O2S:Eu,Tb – red**
- **ZnS/CdS:Cu – green**
- **ZnS:Ag – blue**

disadvantages:
- large mass / dimensions
- 8-10 kV → rtg emitted
- sensitive to magnetic field

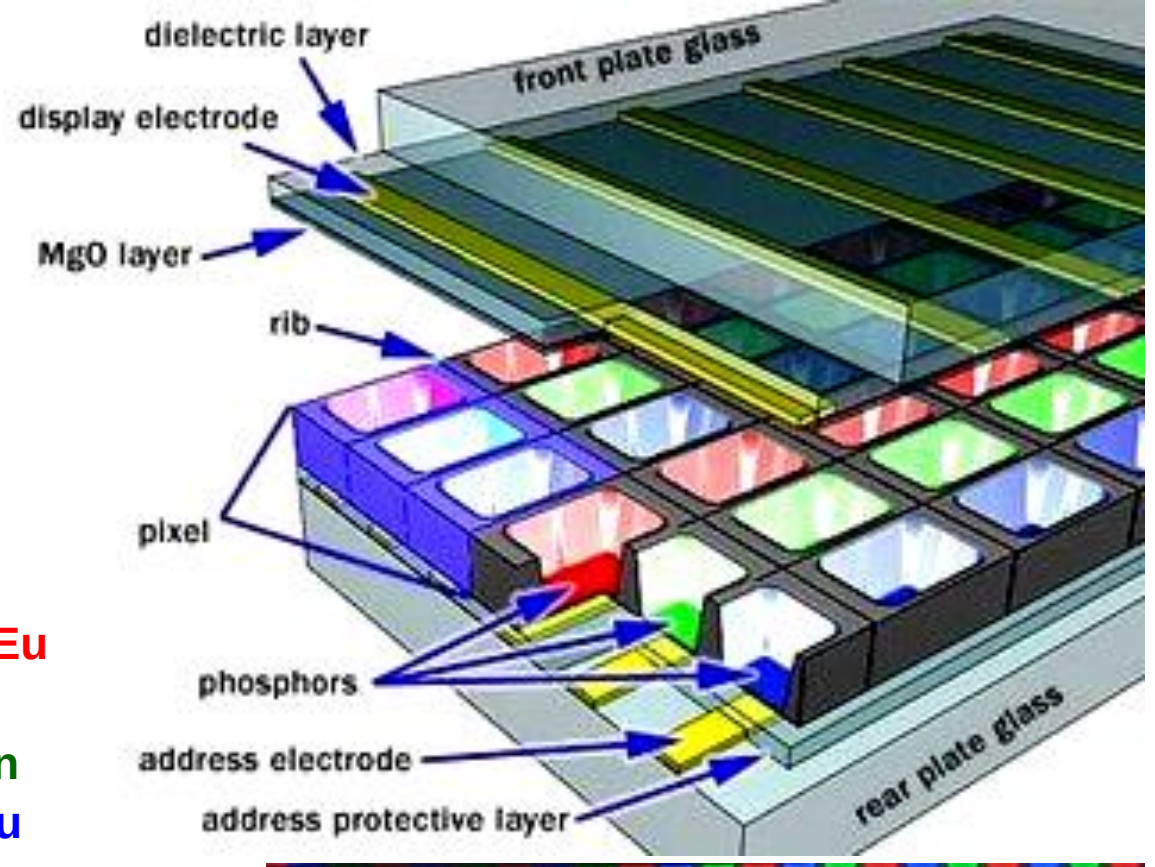
plasma display

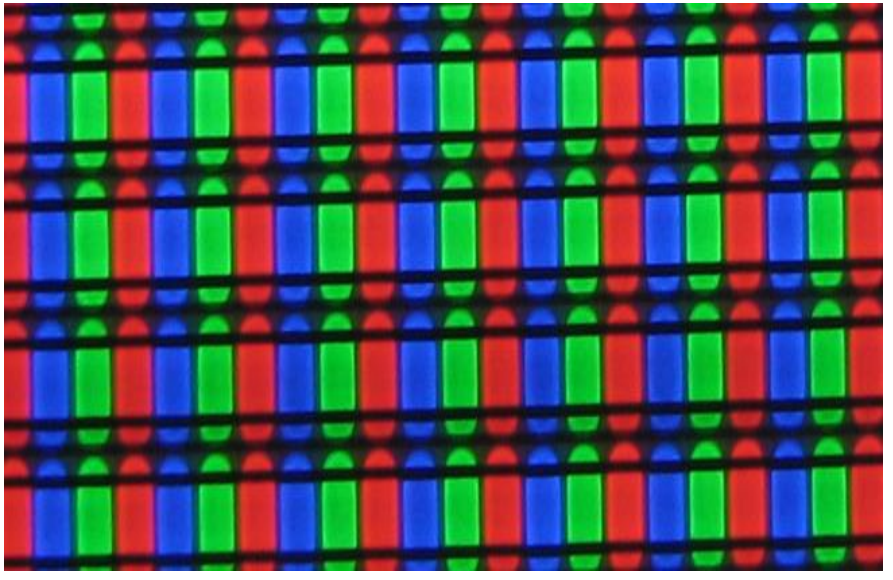
- top elektrode – **I**ndium**T**in**O**xide
- about 200 V dc
- gases: He,Ne,Xe (+Hg) → UV
- cel separator → min interference

phosphor:

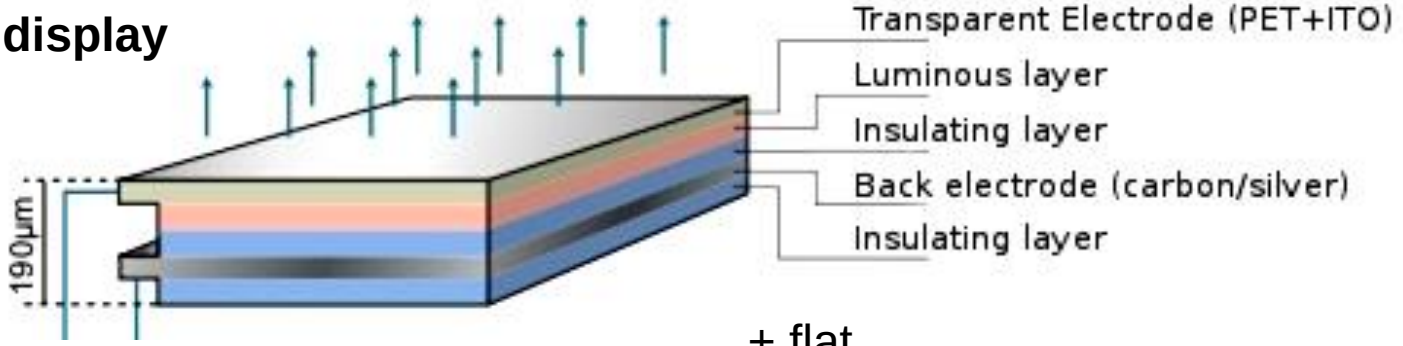
- **red:** Y_2O_3:**Eu**
  $(Y,Gd)BO_3$:**Eu**
- **green:** Zn_2SiO_4:**Mn**
  $BaAl_{12}O_{19}$:**Mn**
- **blue:** $BaMgAl_{14}O_{23}$:**Eu**
  Y_2SiO_5:**Ce**

+ good colors
+ high contrast
+ wide angle
- short life (plasma..)
- low light efficiency
- high power consuption
- large pixels (1÷0,5 mm)





electroluminescent display
(ELD)



1,5 MV/cm → insulation

impulses DC 200V

+ flat
+ low mass
+ weathering resistant
+ vibration resistant
+ simple electronics
+ long life
+ reaction ~msec

monochrom

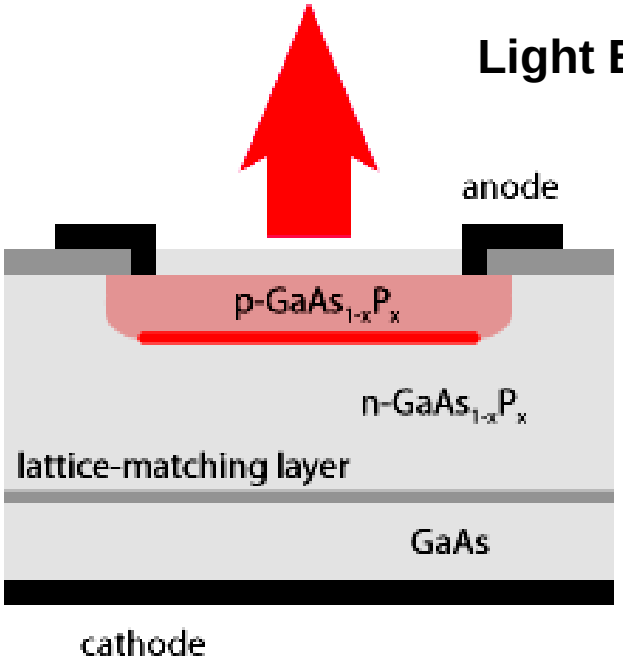
restricted color palette:
- **Zn(S,Se):Mn** – yellow-orange
- **Zn(S,Se):Yb** – green
- **Zn(S,Se):Sm** – red

flat LCD backlight

reliable:
- vehicles
- lifts
- medical devices
- military devices

- **SrS:Ce,Eu / ZnS:Mn** – white
- **SrS:Cu** bluish
- **SrS:Cu / ZnS:Mn – white**

Light Emitting Diode



+ mechanical resistance
+ low mass, low dimensions
+ long life >100000 hr
+ high power efficiency 200 lm/W
+ modulation with constant color
+ reaction time ~μsec → light guides
+ power supply 2-4 V → secure
- sensitive to overvoltage
- toxic GaAs

InGaAsP	1000–1700 nm	infrared
AlGaAs, GaAs	680–860 nm	red – infrared
InGaP	660–680 nm	red
GaAsP, GaAsP:N	610–650 nm	yellow – red
AlInGaP	590–620 nm	green – yellow
GaP, GaN	565 nm	green
InGaN/GaN, ZnS,ZnSe	450–530 nm	blue
SiC	460 nm	blue
InGaN	350-390 nm	UV – blue
diament	340 nm	UV

LED AlInGaP – Red and Amber (typical 2.4V, 350mA)

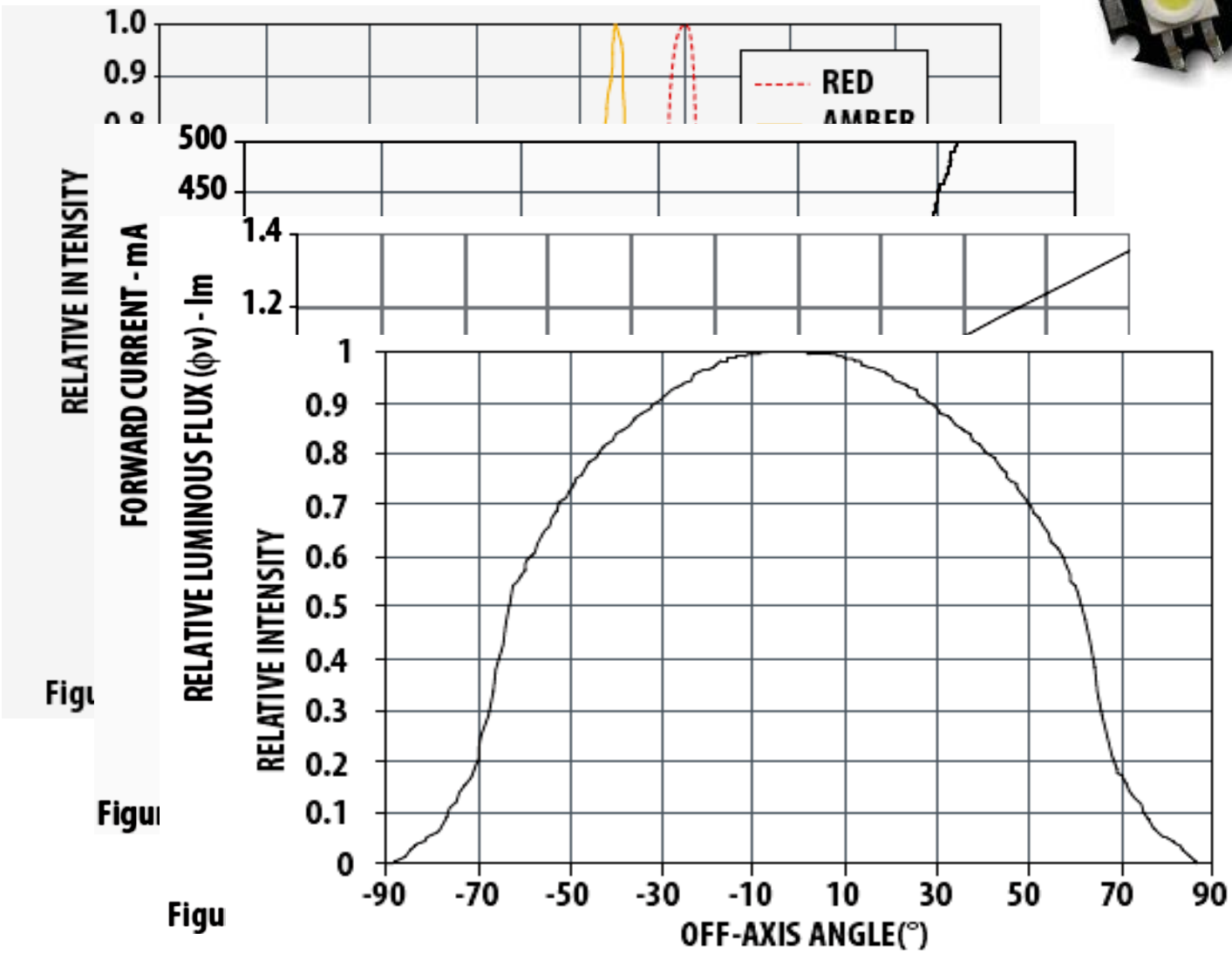


Figure 4. Radiation Pattern for AlInGaP

LED InGaN – Green, Blue, Cool White, Warm White (typical 3.6V, 350 mA)

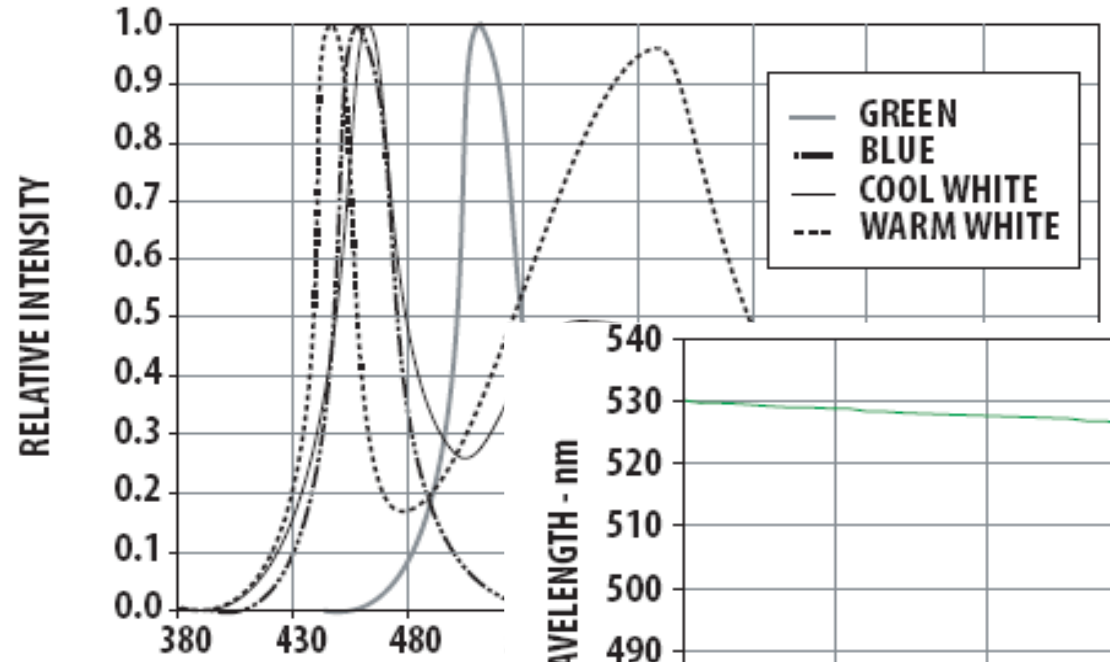


Figure 7. Relative Intensity vs. Wa

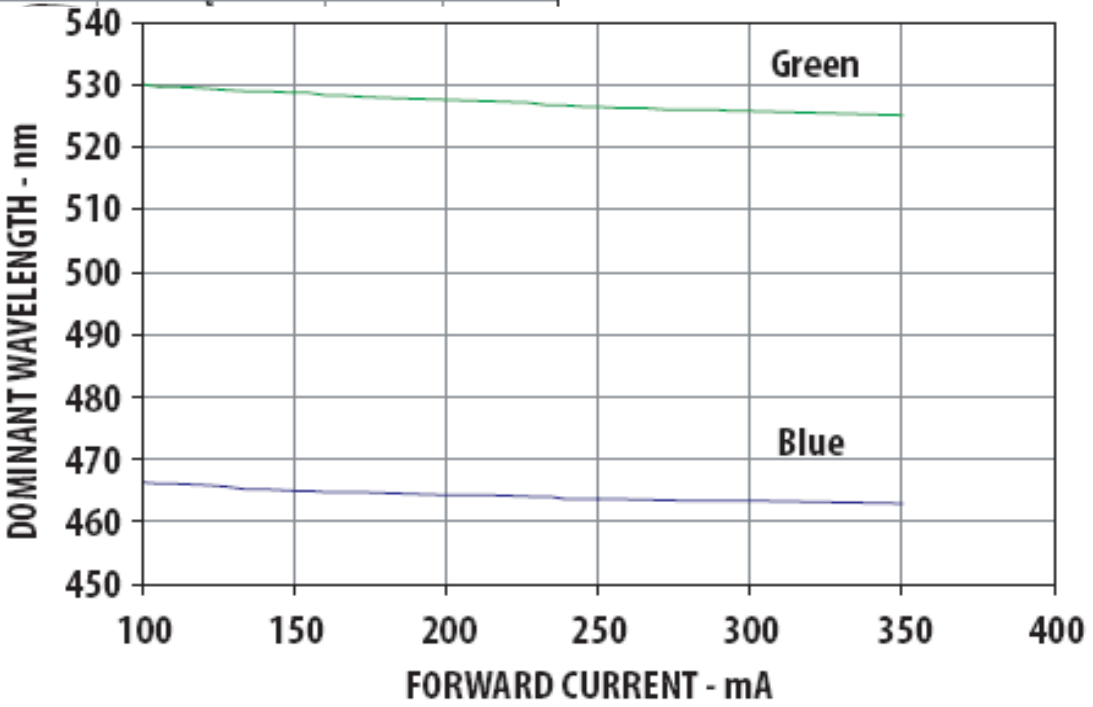


Figure 12. Dominant wavelength vs. forward current – InGaN devices

1 incadescent

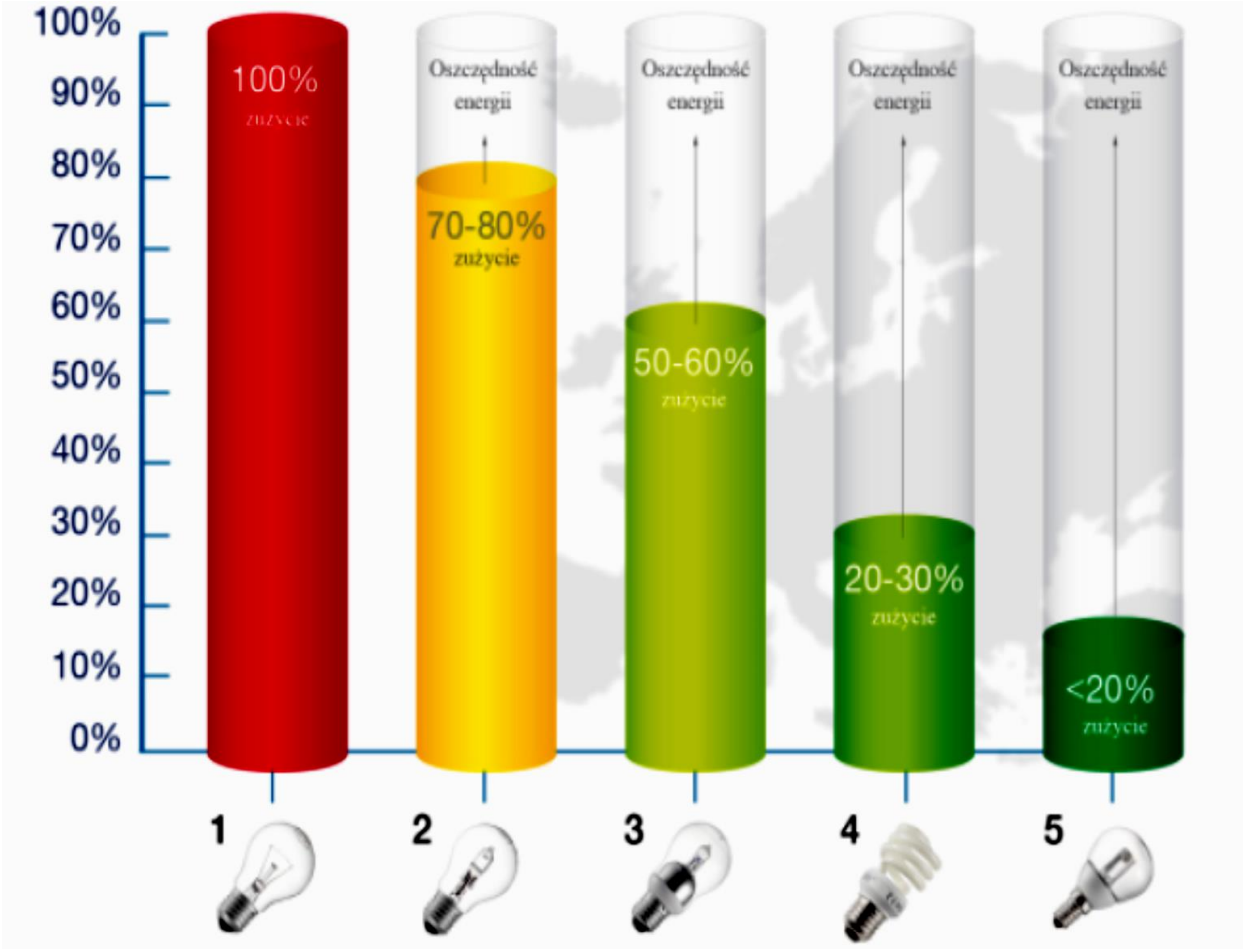
2 halogen +Xe

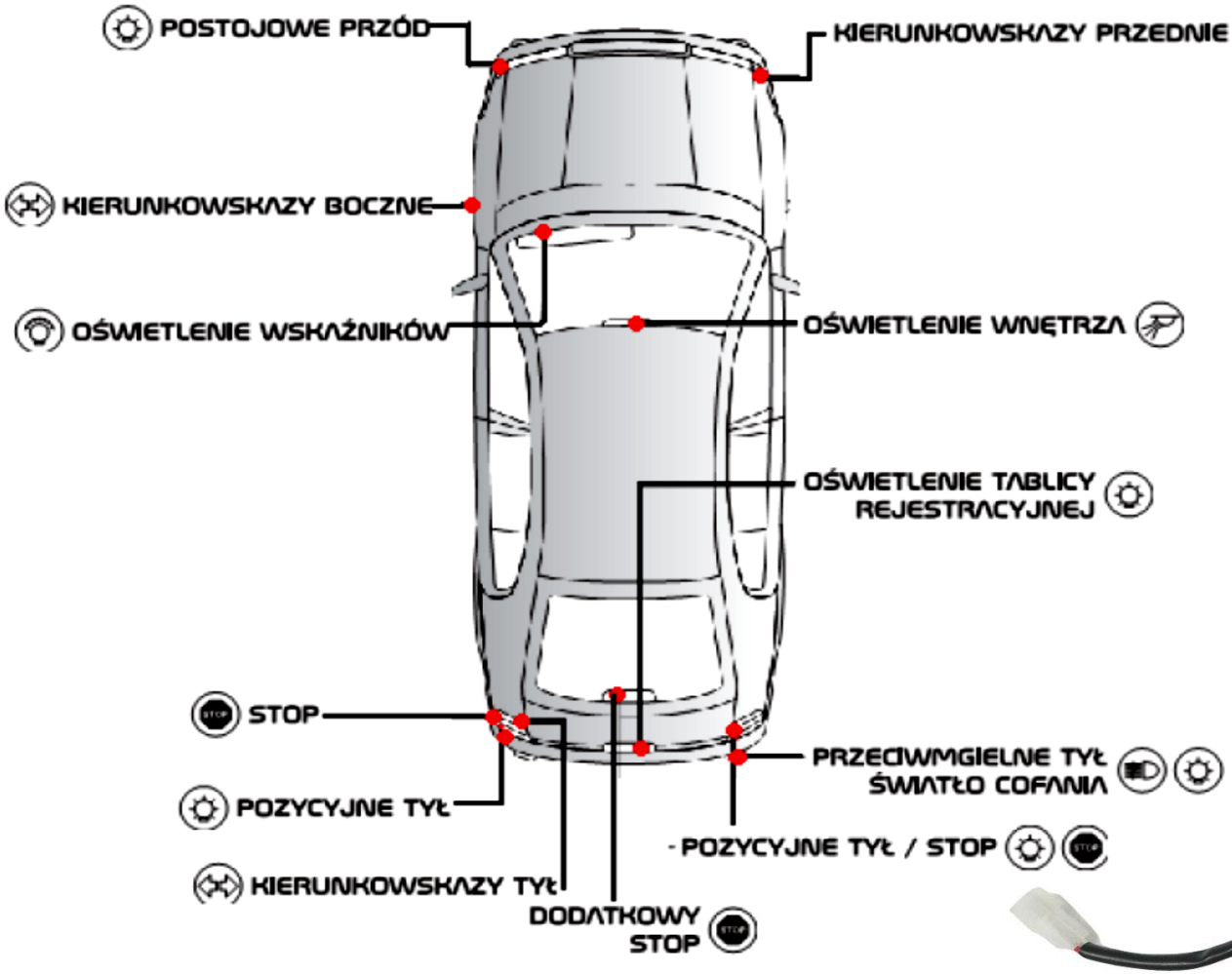
3 halogen + IRC coating

4 compact fluorescent (CFL)

5 LED

power consumption



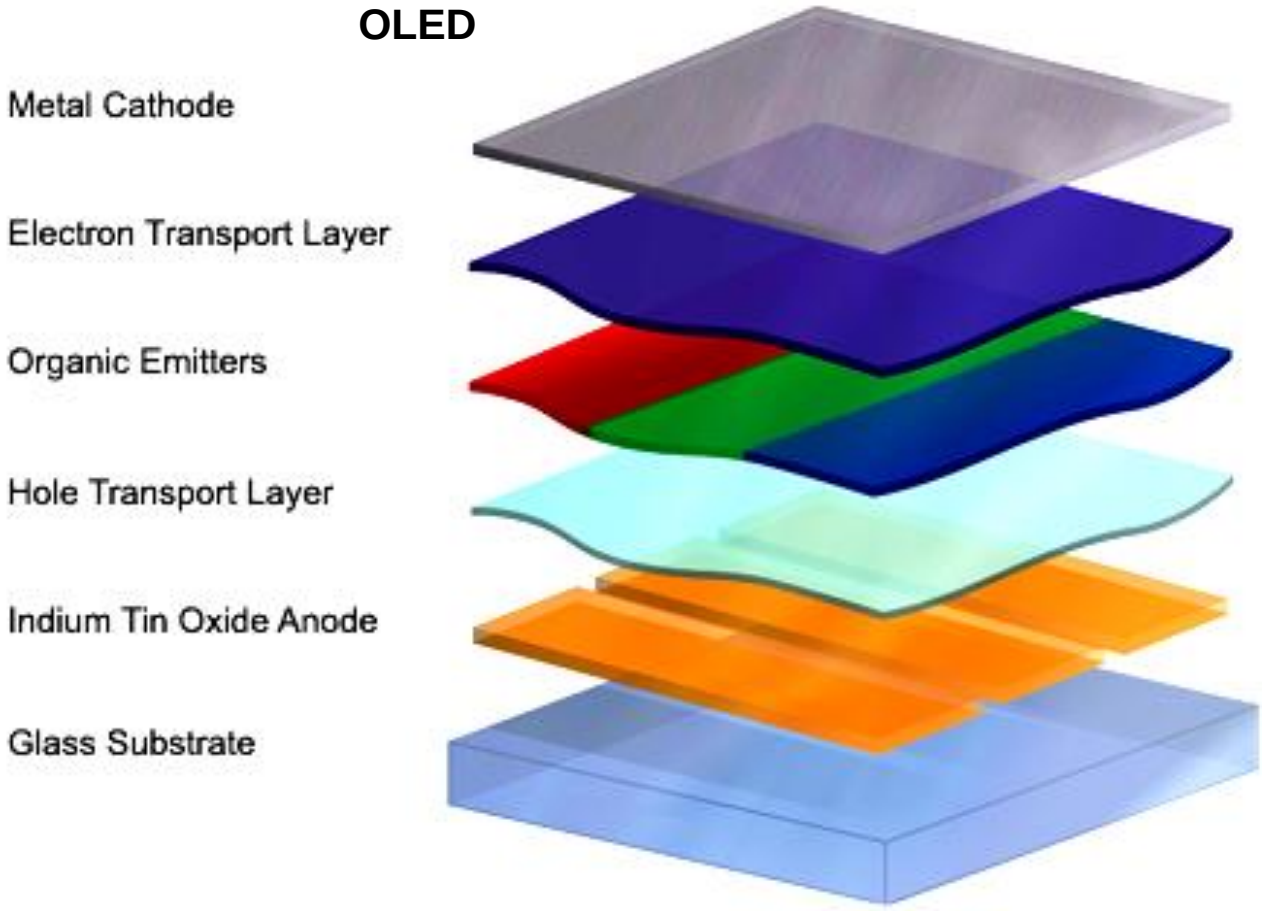


automotive: LED reaction x120 fast
100km/h → additional 3 m for stopping

LED banners

- **hi light intensity**
- **hi contrast**

OLED



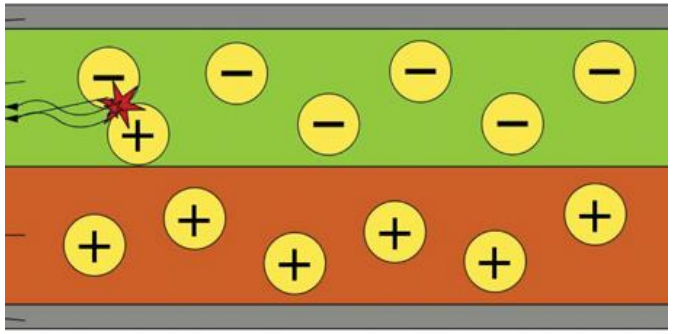
cathode – Al, Ca
electron inhection

emission layer
negative charge

conduction layer
vacancy abundant

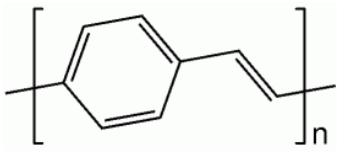
anode
ITO = Indium-Tin-Oxide
transparent conductor

electron + vacancy recombination
= light emision

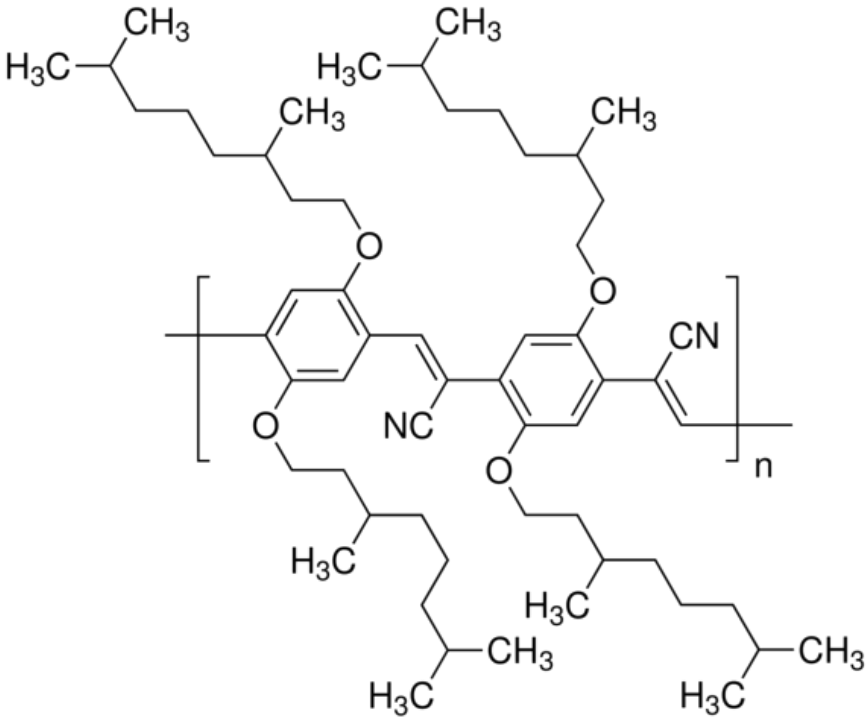


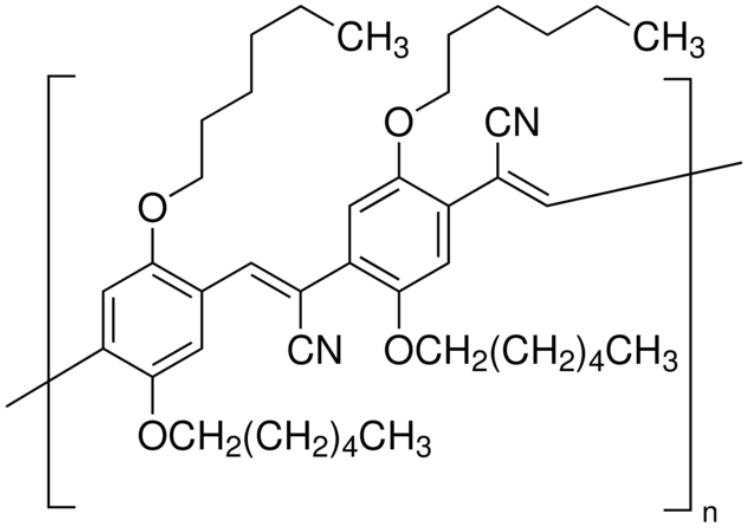
conductive polymers:

polyphenylenevinylene (PPV)



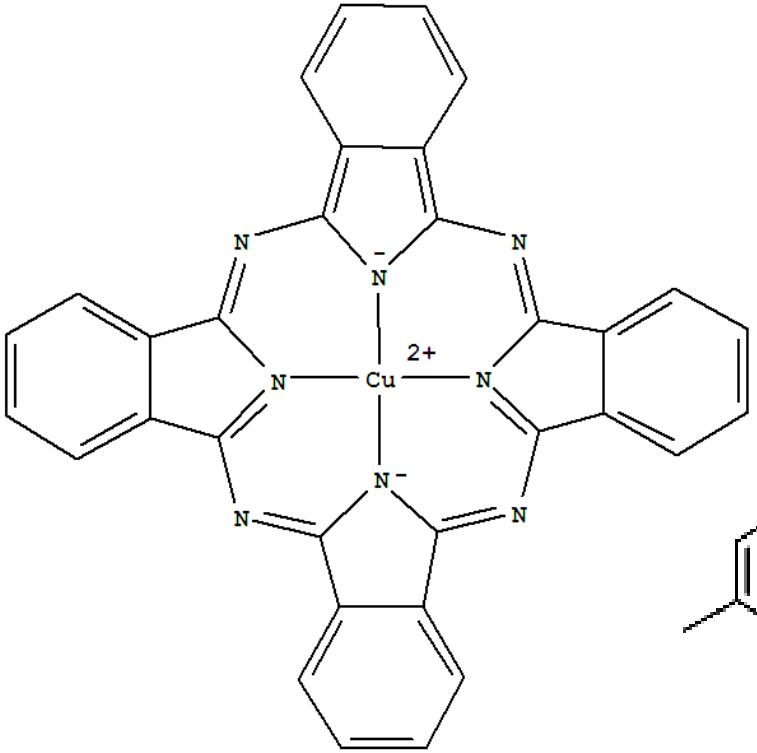
cyanepolyphenylenevinylene (CN-PPV)





poly(2,5-di(hexyloxy)cyanoterephthalylidene)

poly(2,5-di(3,7-dimethyloctyloxy)cyanoterephthalylidene)

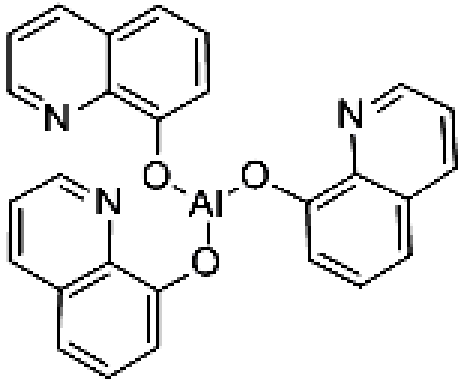


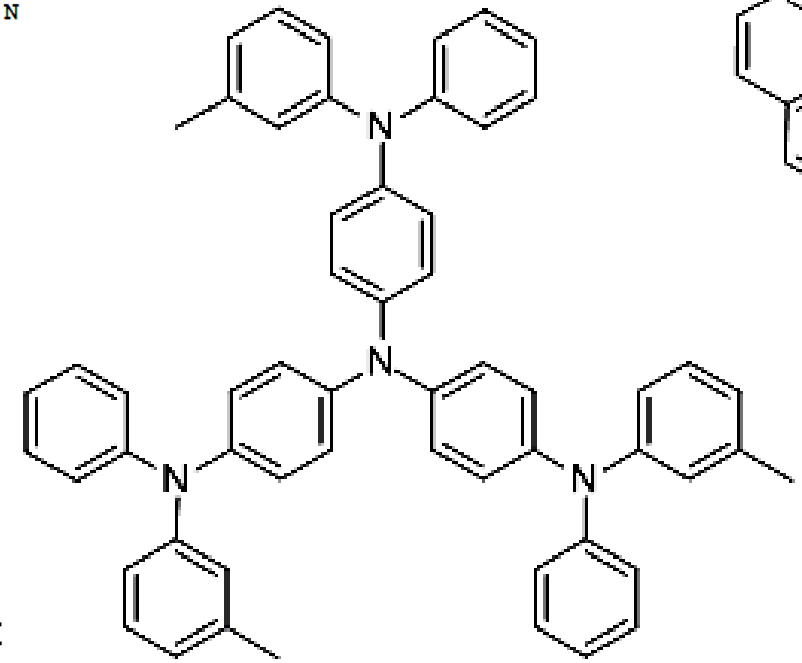
hole injection

copper phthalocyanine

tris(8-oxyquinoline)aluminium

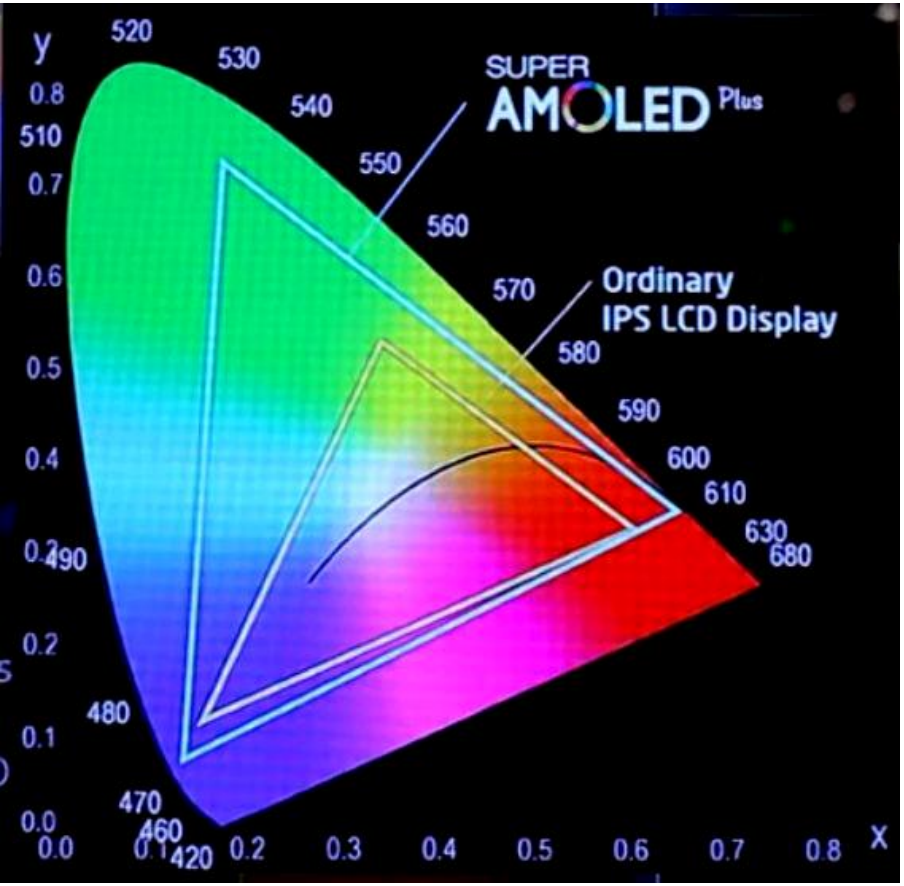
electron transport





hole transport

m-MTDATA,4,4',4''-Tris(N-3-methylphenyl-N-phenylamino) triphenylamine



OlED advantages:

- **low power consumption (-30% /LCD)**
- **wide color palette**
- **high luminance**
- **non-polarized light**
- **high contrast (100000 :1)**
- **low production cost (4”=$50, ~LCD)**
- **flat (5 mm)**
- wide viewing angle
- elastic (polymers)
- low reaction time 0.02 ms

disadvantages:

- **short life** (RG~200 000 h, B~20000 h)
- **moisture sensitive** (if unsealed)