Materials Development for OLED Lighting

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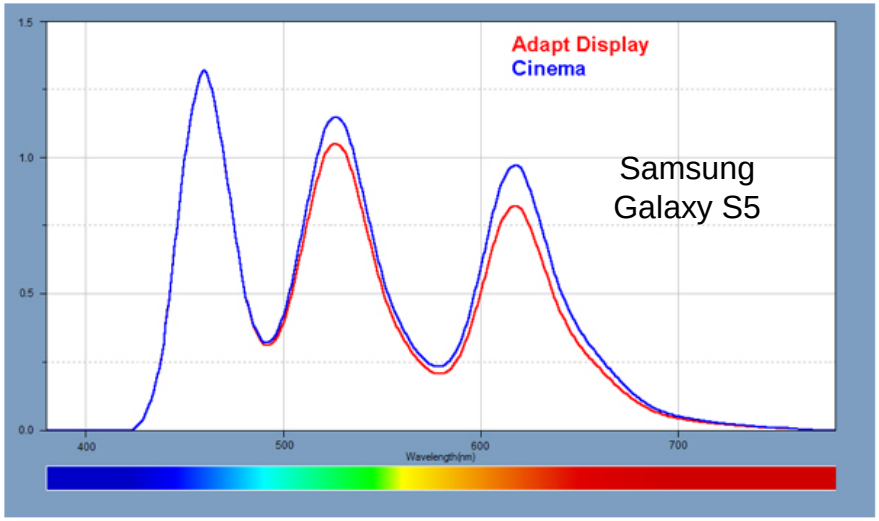
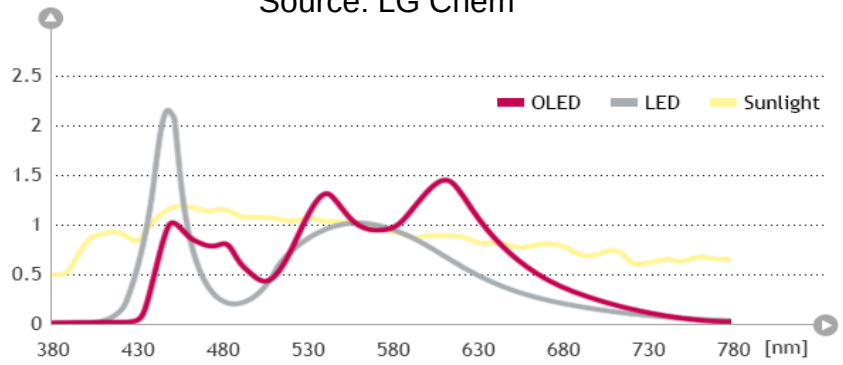
Spectrum of Panels for Display & Lighting



Spectral Power Distribution

Source: LG Chem



Normalization (Relative Distribution) based on the value (100) of 560nm

- Blue for lighting is broader, often double-peaked. Are two peaks optimal, or just a characteristic of available light blues?
- Broad blue is needed to improve lm/W efficiency in lighting.
- Green and red for lighting show significant overlap. This is also needed for high lm/W efficiency.
- OLED lighting could benefit from more coverage at higher wavelengths (improved R9).

Do we need to develop materials specifically tailored to lighting?

Materials Development for OLED Lighting

Currently, OLED material makers leverage materials used widely in the display industry to support the fledgling lighting industry.

- Advantages
  - ✓ R&D already invested
  - ✓ Materials are proven in manufacturing
  - ✓ Volumes already established, so lighting can benefit from lower pricing due to high-volumes needed for display
- Opportunities More Specific to Lighting Applications
  - Optimal whites for lighting are not necessarily the same as for display → different materials needed?
    - State-of-the-Art emitters are optimized for display (very deep blue, narrow spectra). Most lighting architectures would benefit from a lighter, broad blue.
    - Oranges/Yellows/Ambers are useful in lighting, but not as widely in display. A broad, yellowish green can be useful in many lighting stacks.
  - Materials for the CGL are more critical for lighting, as manufactures move to stacks with 3 tandem units. Air-stable p- and n- dopants with no absorption are required. The p-dopant may need to be solution processable, to be compatible with future HIL materials.
  - A solution processable HIL compatible with a VTE stack may be useful for lighting, to smooth rough anodes and reduce deposition time for thick layers.

Conclusion

There are opportunities for the DOE to impact the performance and accelerate the adoption of OLED lighting by funding targeted material development.

- Solution processable HIL compatible with a VTE stack
- Materials for the CGL and transport layers
  - Air-stable, solution-processable p-dopant with no absorption
  - n-dopants with improved handling (air-stable, reasonable evaporation temp.)
- Red with emission stretching into long wavelengths, to improve R9
- Orange/Yellow/Amber emitters & associated hosts; well-matched to the blue
- Broad, light blue