SYNOPSYS®
Silicon to Software™

RSoft Application: OLED-Based Display

OLED Color Consistency Vs. Viewing Angle

Overview

A display manufacturer in Asia needed to create an OLED-based display for a mobile phone application with consistent color uniformity and brightness when viewed at any angle.

The Challenge

Most displays, while there is uniform color and brightness when viewed on-axis, have degraded image quality as the viewer moves off-axis. The color and brightness performance must be studied and optimized as a function of viewing angle, requiring novel OLED geometries and materials, possibly including nano-textures. The RSoft™ FullWAVE™ and LED Utility™ tools are ideal solutions for this design challenge.

Figure 1. Side and front display views

The Solution

RSoft FullWAVE finite-difference-time-domain (FDTD) simulation software models light propagation of a single dipole source within the OLED structure, including non-scale geometric features and custom material definitions.

The RSoft LED Utility software incoherently sums several FullWAVE results to reproduce the effect of multiple dipole sources, polarization, and wavelength within the emission layer. Device performance versus any design parameter (geometric, material, etc.) can be studied to find the optimal device configuration.

The Result

The far-field pattern for a simple flat OLED device is shown as a function of the entire viewing angle and visible spectrum (Figure 2).

Two cross-cuts are shown: angular intensity distribution at 650 nm; and spectral distribution at 30 degrees (Figure 2). At 650 nm, uniform brightness is achieved up to 30 degrees off axis.

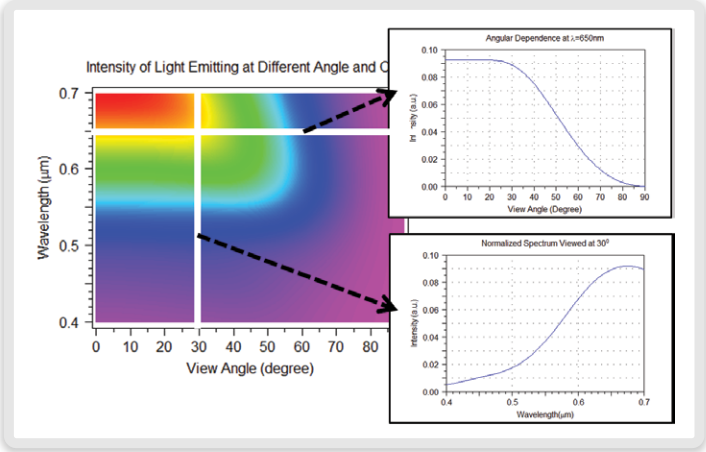

Figure 2. Far-field pattern for a simple flat OLED device (left); angular intensity and spectral distribution plots (right)

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