MAR12-2011-020198

Abstract for an Invited Paper
for the MAR12 Meeting of
the American Physical Society

Hewlett-Packard's Approaches to Full Color Reflective Displays

GARY GIBSON, Hewlett-Packard Laboratories, Hewlett-Packard

Reflective displays are desirable in applications requiring low power or daylight readability. However, commercial reflective displays are currently either monochrome or capable of only dim color gamuts. Low cost, high-quality color technology would be rapidly adopted in existing reflective display markets and would enable new solutions in areas such as retail pricing and outdoor digital signage. Technical breakthroughs are required to enable bright color gamuts at reasonable cost. Pixel architectures that rely on pure reflection from a single layer of side-by-side primary-color sub-pixels use only a fraction of the display area to reflect incident light of a given color and are, therefore, unacceptably dark. Reflective devices employing stacked color primaries offer the possibility of a somewhat brighter color gamut but can be more complex to manufacture. In this talk, we describe HP's successes in addressing these fundamental challenges and creating both high performance stacked-primary reflective color displays as well as inexpensive single layer prototypes that provide good color. Our stacked displays utilize a combination of careful light management techniques, proprietary high-contrast electro-optic shutters, and highly transparent active-matrix TFT arrays based on transparent metal oxides. They also offer the possibility of relatively low cost manufacturing through roll-to-roll processing on plastic webs. To create even lower cost color displays with acceptable brightness, we have developed means for utilizing photoluminescence to make more efficient use of ambient light in a single layer device. Existing reflective displays create a desired color by reflecting a portion of the incident spectrum while absorbing undesired wavelengths. We have developed methods for converting the otherwise-wasted absorbed light to desired wavelengths via tailored photoluminescent composites. Here we describe a single active layer prototype display that utilizes these materials along with an innovative optical out-coupling scheme. Further benefits of our approach include means for highly power-efficient back-lighting under low ambient light conditions and the possibility of video rate operation.