

Materials Science and Engineering Doctoral Defense

New Materials and Device Designs for Organic Light-Emitting Diodes

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abstract

Research and development of organic materials and devices for electronic applications has become an increasingly active area. Display and solid-state lighting are the most mature applications and, and products have been commercially available for several years as of this writing. Improvements are being made in lightweight, flexible, rugged panels that use organic light emitting diodes (OLEDs), which are particularly useful in developing regions with limited energy availability and harsh environments.

Displays also benefit from more efficient materials as well as the lighter weight and ruggedness enabled by flexible substrates. Displays may require different emission characteristics compared with solid-state lighting. Full-color OLED displays up to and including television size are now commercially available from several suppliers, but research continues to develop more efficient and more stable materials.

This research program investigates several topics relevant to solid-state lighting and display applications. One project is development of a device structure to optimize performance of a new stable Pt-based red emitter developed in Prof Jian Li's group. Another project investigates new Pt-based red, green and blue emitters for lighting applications and compares a red/blue structure with a red/green/blue structure to produce light with high color rendering index. Another part of this work describes the fabrication of a 14.7" diagonal full color active-matrix OLED display on plastic substrate. The backplanes were designed and fabricated in the ASU Flexible Display Center and required significant engineering to develop; a discussion of that process is also included.

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