

Theme : OLED Material

Subject: Experimental and Computational Framework for OLED Degradation

Introduction

Organic light emitting devices (OLED) are thin, light, power efficient, environmental friendly, bendable and potentially low cost light sources which are used in displays and lighting applications. However, degradation of organic light emitting materials under electrical current is one of the primary issues limiting OLED performance. The goal of this research project is to investigate experimentally fundamental physical-chemical processes leading to OLED degradation and to develop a theoretical framework towards quantum-mechanical calculation-aided design of novel durable materials for OLEDs.

Scope

Challenges that significantly advance current understanding of the fundamental processes leading to defects formation in OLED structures require:

- Investigation of processes leading to defects formation under electrical field and external light of selected wavelengths
- Utilization of combination of contemporary sensitive experimental methods (e.g. EPR, IR spectrometry, chromato-mass spectrometry, etc.)
- Accurate quantum-mechanical calculations of molecular degradation pathways

Research questions

Currently, some of the following research questions have to be addressed in the project:

1. Spatial and temporal characterization of processes leading to defects formation
2. Elucidation of exciton and polaron annihilation mechanisms leading to molecules degradation
3. Development and validation of theoretical framework based on quantum mechanical calculations towards predictive modeling of OLED stability
4. Proposition of novel materials with superior electrochemical stability

Expected Deliverables

The following is open to negotiation:

- Detailed progress reports every 3 months summarizing accomplishments
- Determination of degradation pathways and mechanisms for selected OLED molecules (particular molecules/OLED structures is subject to discussion)
- Theoretical quantum mechanical framework for OLED molecules stability modeling
- Suggestion of new materials and/or new OLED structures
- Patents with Samsung (if agreed)