Materials Science & Engineering Doctoral Defense

Luminescent Cyclometalated Platinum and Palladium Complexes with Novel Photophysical Properties

School for Engineering of Matter, Transport and Energy

Eric Turner
Advisor: Jian Li

abstract

Organic light emitting diodes (OLEDs) are a rapidly emerging technology based on organic thin film semiconductors. Recently, there has been substantial investment in their use in displays. At the heart of an OLED are emissive molecules that generate light in response to electrical stimulation. Ideal emitters are efficient, compatible with existing materials, long lived, and produce light predominantly at useful wavelengths. Luminescent cyclometalated iridium complexes are currently the dominant flavor of emissive material, but platinum and palladium systems are exciting alternatives to explore due to the inherent flexibility of their square planar geometry.

To this end, a series of tridentate platinum complexes were designed. A synthetic method utilizing microwave irradiation was explored, as well as a study of the effects ligand structure had on the excited state properties. Results and techniques developed in this endeavor were used as a foundation to design a new series of tetradentate platinum and palladium complexes with markedly improved performance. This included a nearly 100% electron-to-photon conversion efficiency for a platinum compound, and a palladium complex with an efficiency an order of magnitude higher than other reported palladacycles. A third generation of carbazolyl based complexes followed, which exhibited novel properties such as ultra-narrow emission and metal assisted delayed fluorescence.

May 23, 2014; 12:00 PM; ERC 490