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Luminescent properties of light emitting devices based on a new terbium β-diketonate complex

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The recent interest in the studies of luminescence properties of rare earth light-emitting organic complexes had been greatly intensified due to their potential use in photonic devices such as OLEDs, optical markers and luminescence sensors [1-3]. In addition, these complexes emit with a narrow emission spectrum characteristic of intra-atomic transitions of the central ion, which make them with organic ligands candidates for full color OLEDs applications. On the other hand, it is well known that the emission properties of a luminescent molecule can be influenced by the presence of a metal interface. There are still many issues under debate concerning the nature of the interface created by deposition of the metal layers over the organic film, interface structure and interaction mechanisms between metal and organic active layers for light-emitting devices. The understanding of the photophysical processes related with these materials in the neighborhood of interfaces are important for future applications.

In this work we investigated the luminescent properties of thin films based on a new Terbium complex based on [1,2,5] thiadiazolo [3,4-f][1,10]phenanthroline and ACAC (see Figure 1) near the Al/Ca metal interfaces of a OLED structure. The samples were characterized by Absorption, Raman, CW time resolved luminescence spectroscopy. Figure 2 shows the photoluminescence characteristic of Terbium complexes, with the dominant emission around 546 nm, where the electronic transitions are indicated. To study the decay kinetics of the luminescence, a second harmonic of a Q-switch Nd:YAG (532 nm, 6Hz repetition rate) laser was used as the source of excitation. The excitation pulse width was estimated to be about 5 ns. The decay luminescence was detected by a SRM 2 monochromator equipped with a GaAs PM tube. A digital oscilloscope processed the signal averaging over 50 pulses. With time resolved measurements, we study the role of interface and OLED structure in the excited state lifetime of Terbium complex. In particular, we are interested on the effect of migration of metal (Ca or Al) into the film, possible doping or degradation effects on emission properties of the Terbium complex dependent on metal thickness and on metal/organic layer separation.

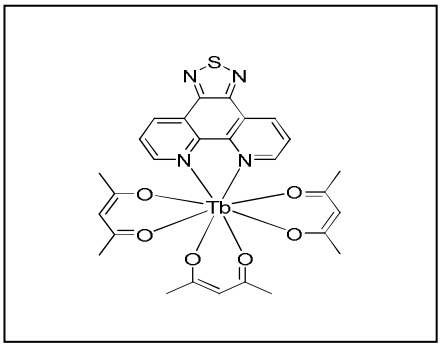

Figure 1: Tb $(ACAC)_3$TDPHEN] complex structure.

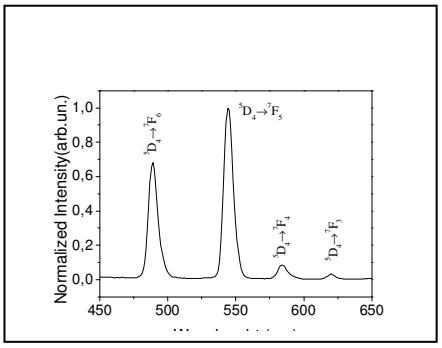

Figure 2: Photoluminescence spectrum at room temperature of a thin film of the Terbium complex.

References

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