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ORGANIC LIGHT EMITTING DIODES (OLED)

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Abstract. *Organic Light Emitting Diodes (OLED) now reach the third phase concerning efficiency. The first devices are based on pure organic materials, and the second and third generations are based on combinations between metals and organic ligands in so-called organometallics for which their emission external quantum efficiency is increased. The second generation is now widely used in large displays reaching high efficiency because of the spin-orbit coupling between metal and their ligands, which induces intersystem crossing processes. The third generation of OLED comprises an increased external quantum efficiency obtained by adequately choosing the ligands, reaching a theoretical value of 100%. These OLEDs will be briefly described with their advantages and the technologies necessary for next-generation displays.*

Keywords: organic light emitting diodes, organic compounds

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1. Introduction

Since 1987, the first electroluminescent device was obtained and the area of organic light emitting diodes (OLED) has grown from the laboratory to the industrial scaling of color displays [1]. The same trend follows the evolution from mono-color, mainly green, to multicolor electroluminescence displays by changing the architecture of the emitting compound embedded in the active layer. The first electroluminescent device was based on the aluminium tris-hydroxyquinoline (Alq_3), and the light emission was due to the delayed fluorescence induced by the presence of Al^{3+} ions. Hence, the exponential current-voltage dependencies accompany the green light of these devices but also exponential luminance versus the applied potential [2,3].

The second generation of OLED devices and color displays, which are now on the market, uses heavy metal ions as the central part of the organometallic compounds such as platinum (Pt), osmium (Os) and the most efficient iridium (Ir) for which the electroluminescence process is based on the phosphorescence as an electronic transition from a forbidden state (triplet state). This process is facilitated by the intersystem crossing from the singlet to triplet transition induced by the spin-orbit coupling between the heavy ion and the organic ligands [4-10]. In these cases, the outer electrons of the metals are involved in the electronic

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