

## USE OF RED-EMITTING OLEDs FOR ILLUMINATION OF PLANTS GROWING IN THE GREENHOUSE

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**Resume:** An OLED with a configuration of [glass/ITO/PEDOT:PSS/PVK:Ln<sup>3+</sup>(fluorinated  $\beta$ -diketonate)<sub>3</sub>(*polypy*)/Ca/Al] which emits red light has been proposed for illumination of plants growing in greenhouse

### Detailed description:

In horticultural plant production greenhouses are often equipped with artificial light sources to expand the day length in order to grow plants over an extended time period of the year. This allows the producer to bring plants to the market on demand. Since room in greenhouses is limited, it is desirable to grow some plants or seeds in compact racks, in which plants are grown in shelves where several shelves may be arranged on top of each other. Since such an arrangement shields most of the daylight from the plants in the lower shelves, artificial lighting is necessary. Today several types of plant lamps are used in greenhouses: incandescent light bulbs, Sodium high-pressure light bulbs, fluorescent gas discharge lamps, etc. All these light sources have the drawback of being punctual sources and not distributing light as homogeneously as sunlight.

In our method for growing plants, light sources using an organic electroluminescence sheet (OLEDs) have the advantage of being suitable of large area manufacturing. To achieve a generous growth of the plant, the light emitted by the group of OLEDs should consist of approximately 80% to 90% red light and 10% to 20% blue light.

In our Project we carried out I+D+i on new red-emitting OLEDs with lanthanide(III) complexes as electroluminescent materials. With the new materials, based on eight-coordinated praseodymium(III), neodymium(III), erbium(III) and ytterbium(III)  $\beta$ -diketonate complexes of the type [Ln<sup>3+</sup>(fluorinated  $\beta$ -diketonate)<sub>3</sub>(*polypy*)], where *polypy* is either 2,2'-bipyridine, 5-nitro-1,10-phenantroline or bathophenanthroline, OLEDs with the following configuration: [Glass/ITO/PEDOT:PSS/PVK:Ln<sup>3+</sup>(fluorinated  $\beta$ -diketonate)<sub>3</sub>(*polypy*)/Ca/Al] have been manufactured. For the Er<sup>3+</sup> device we evidenced excitation maximum at 472 nm y emissions at 700 nm y 1538 nm.

### Market:

Since 2004 three foreign patents have explored the use of OLED in the horticultural plant production greenhouses market. They are the entitled: Illuminating device (ref WO 2008078277 20080703); Controlling device for a greenhouse (ref. WO 2008068699 20080612 and US 2005/0252078 A1); and Plant growth device (ref WO 2008047275 20080424 and JP 2004/321074 A). Nevertheless, none of them has claimed, as we have, the syntheses of a specific red-emitting OLED for above purposes. We hope that commercial firms pay attention to our research results in this field

**References:**

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**Figures:**



**Red-emitting device, suitable for large area manufacturing, promising for use in illumination of plants in greenhouses.**