New compounds for the manufacture of tunable OLED devices

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Macarena Poyatos and Antonio Guerrero. Credit: Damián Llorens

The research groups of Organometallic Chemistry and Homogeneous Catalysis and Photovoltaic and Optoelectronic Devices at the Universitat

Jaume I, UJI, have developed new organic compounds characterized by a higher modularity, stability and efficiency, which could be applicable in the semiconductors industry for using them in electronics or lighting.

The Universitat Jaume I has started a proof-of-concept project to verify that these compounds have the photoluminescent and electrochemical properties required for the manufacture of tunable OLEDs that can emit in the blue portion of the visible spectrum, thus applying lower voltages and achieving a greater efficiency and a longer lifetime.

The prepared compounds have tunable electronic and physical characteristics (hence, small changes in the original structure would make it possible to tune the photophysical properties of the final compound); they allow the manufacture of solution-processable OLEDs, thus resulting in a cheap, scalable and more convenient method for industrial purposes; they are soluble in non-toxic solvents, and the structure of their molecules allows electronic connectivity between the two ends and the adjustment of the properties of electronic transport, thus improving the efficiency of the device.

During the research conducted by Macarena Poyatos and Antonio Guerrero, two families of pyrene-based nitrogen-donor compounds have been developed, given that pyrene is the chromophore of choice in fundamental and applied photochemical research. The synthesis of these compounds involves four steps at the most, which results in the generation of lower amounts of waste and the minimization of the use of auxiliary reagents and solvents.

The family of neutral pyrene-based organic compounds can be prepared on a large scale and have proved to be very stable. They show strong emission in the blue portion of the electronic spectra and high quantum yields. The second family of compounds have been prepared starting out with the above mentioned neutral compounds, and they are also based on

pyrene. This family of nitrogenous organic salts is highly robust, shows strong emission in the blue portion of the electronic spectra and offers moderate quantum yields.

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Once they are implemented in OLED devices, the developed and patented compounds will form part of the light-emitting layer together with what is known as host. The so-called host, if used in isolation, would not produce visible light; but when adding an emitter to it (an organic or an organometallic compound), the emission occurs in the visible part of the spectrum. Since this technology allows the OLEDs to work at low voltages, the device is under less electronic strain and therefore exhibits longer emission lifetimes.

Researchers are seeking a manufacturer of OLED devices interested in the production and/or the commercialization of such devices based on the compounds developed by these two research groups.

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