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Pure Hydrocarbon Hosts for High Performance Phosphorescent OLEDs

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In the Organic Electronic technologies, Phosphorescent Organic Light-Emitting Diodes (PhOLEDs) are the 2nd generation of OLEDs and have encountered a fantastic development. A PhOLED uses a Host-Guest Emitting Layer (EML), which consists in a Triplet Emitter (Guest) disperse into an appropriate organic semi-conductor (Host).¹ During the past two decades, intense research has been focused on developing high-efficiency host materials. Many molecular design strategies have been developed to gather within a single host all the required properties to fit with a phosphor within a device. All these molecular engineering works of host materials have undoubtedly driven the field. The most efficient are the bipolar hosts constructed on a 'Donor/Acceptor' molecular design.²⁻³ This design is widely known and consists to judiciously assemble electron-rich and electron-poor fragments to fit with the required properties. The best host materials achieved over 25% external quantum efficiency in PhOLEDs.³ However, the complicated structure of these molecules increases the synthetic complexity, the environmental footprint and production costs. In addition, the fragile C-N, C-P and C-S bonds of such heteroatoms based hosts are also involved in the OLED instability. Thus, as the instability of OLEDs is one of the most important problem to address at the current stage of development, developing new generations of host materials, without heteroatoms (called PHC for Pure HydroCarbons) has appeared as an important challenge in the field. However, reaching high performance PhOLEDs with host materials free of heteroatoms is a real challenge. In this talk, will be presented our recent advances in the field of PHC host materials for PhOLEDs, which have shown that PHC hosts can now overpassed heteroatoms based host materials.⁴⁻¹¹ The molecular design strategies developed will be presented and analysed in order to show their impact on the electronic and physical properties and the final device performance. PHC represents nowadays a credible new generation of simplified host materials for all colours of PhOLEDs including the appealing white light, which could play a key role in the future of this technology.

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