Supramolecular electronic devices powered with light

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Molecular electronics was born from the concept of using finite molecular orbitals to simulate the basic operational principles of silicon-based devices.[1] More recently, and with the promise of new systems for sensing and energy conversion, the field grew to encompass organic or hybrid organic-inorganic materials such as conjugated polymers and supramolecular materials that possess extended or infinite structures with highly delocalized orbitals. In some of these systems (Figure 1), light can be used to probe or trigger events linked to charge transfer processes, or changes within the active layer. To illustrate this, we will examine how light can be used to commute aromatic oligoamide foldamers between conductive and non-conductive states. These foldamers spontaneously adopt a helical conformation that is particularly conducive to long-distance p-type charge transport,[2] and can be rendered n-type by metalation.[3] However, their robustness makes them challenging for applications requiring a response to outside stimuli such as sensing or photocommutation. Beyond the goal of replacing high criticality rare-earth metals in current OLED devices, the use of supramolecular materials opens new opportunities to test properties that may eventually lead to emerging applications. These might include active materials engineered to respond to outside stimuli, thereby providing a route to responsive organic devices. Using supramolecular interactions, it is possible to design systems in which specific components will either mix or de-mix. The latter case is an example of narcissistic self-sorting and can be used to enhance the color separation in ultra-high resolution RGB OLED devices.[4] The approach is modular, and different systems incorporating specific properties (eg TADF behavior) can be combined using inkjet printing to prepare functional supramolecular electronic devices.[5,6]

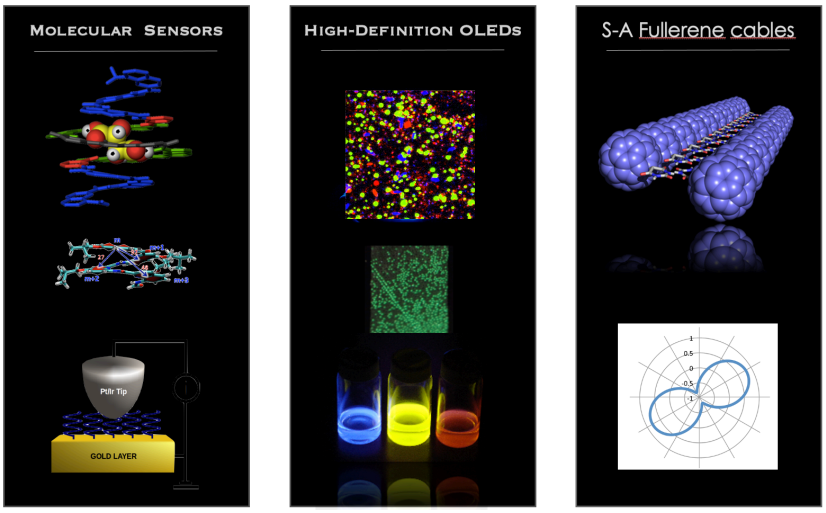

Figure 1. Probing and controlling supramolecular assemblies for applications in molecular electronics.

References

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