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Pathways to improve the chiroptical properties of helicene molecules via exciton coupling chirality.

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Chirality describes an object that can exist as a pair of non-superimposable mirror-images. Despite its well-recognized role in biological functions, chirality remains underexplored in the materials science area. One of the most intriguing properties of chiral molecules is their ability to interact specifically with left- and right-handed circularly polarized light either in absorption (Electronic Circular Dichroism, ECD) or in emission (Circularly Polarized Luminescence, CPL). The latter is becoming a focal point in several photonic applications, ranging from optical communication of spin information to novel display and imaging technologies.[1] Helicenes are polycyclic aromatic compounds with non-planar screw-shaped skeletons formed by ortho-fused benzene or other aromatic rings,[2] and can be regarded as valuable inherently chiral building blocks exhibiting good CPL activity.[3] In this communication, we will present how we took advantage of the exciton coupling chirality phenomenon to boost the CP emission of helicene molecules leading to strong and tunable CPL responses with high dissymmetry factors and the use of such chiral luminophore as active materials for the emission of dissymmetric CP light from organic light-emitting diodes (CP-OLEDs).[4] The direct generation of CP-electroluminescence would not only simplify the architecture of the OLEDs devices via the suppression of the optical polarization filter, but also, it can improve the contrast performances and the efficiency of conventional 2-D displays.[5]

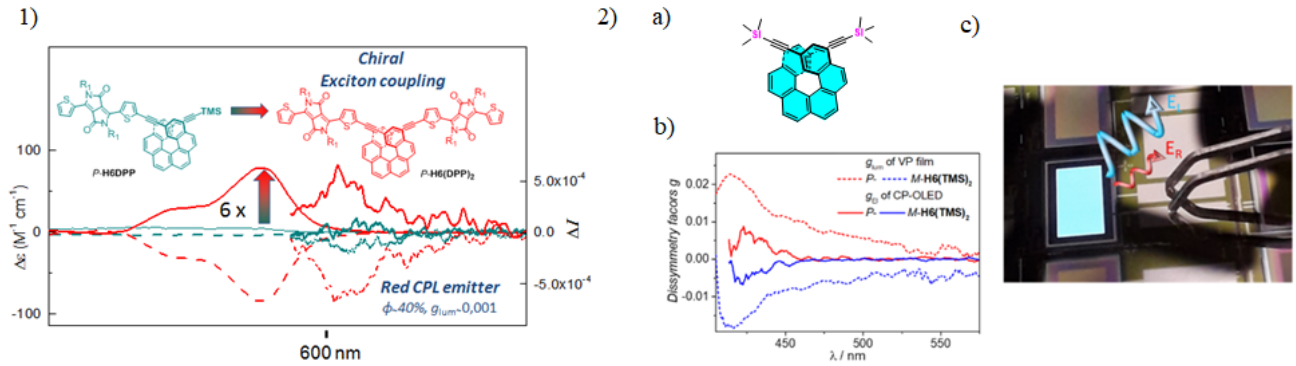

Figure 1. 1) Exciton coupling effect in the ECD and CPL spectra of diketopyrrolopyrrole-helicene derivatives. 2) Chemical structures of helicene luminophores used for CP-OLEDs b) Corresponding plots of the luminescence (from vapor deposition film) and electroluminescence dissymmetry factor, g_{lum} and g_{El}, respectively c) A picture of an operating CP-OLED.

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