专题编号 E：新型有机发光材料和光电特性

Rational design, Synthesis and Applications of Near-infrared Organic/hybrid Emissive Materials

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Near-infrared organic light-emitting materials have aroused rapidly growing attention because of their potential applications in night-vision and information-secured displays, optical communication, phototherapy, and biological diagnoses, etc. However, it is quite challenging to design highly efficient and stable NIR emitting organic lumophores according to the energy gap law. To date, Pt(II) complexes have demonstrated the record maximum external quantum efficiencies (EQEs) for NIR-organic light emitting diodes (NIR-OLEDs). However, those devices generally suffer from severe efficiency roll-off with increasing current density. Since 2009, we have designed and synthesized a series of NIR-emitting cationic and neutral Ir(III) complexes based on highly conjugated benzo[g]quinoline, benzo[g]quinoxaline and benzo[g]phthalazine derivatives and the NIR-OLEDs based on those Ir(III) complexes demonstrated small efficiency roll-off and maximum EQEs up to 4.5% in the 750–800 nm range. In addition, we have demonstrated NIR-emitting cationic Ir(III) complexes as phosphorescent dyes for live cell imaging.

Given that the price and rarity of noble metals would limit their mass production and future application, approaches to utilize the 75% triplet excitons of organic fluorescent materials are highly desirable to enable highly efficient NIR-OLEDs with cost advantage. Recently, we realized high-efficiency and low efficiency roll-off fluorescent NIR-OLEDs through efficient triplet fusion of a bipolar host doped with a special naphthoselenadiazole emitter (4,9-bis(4-(2,2-diphenylvinyl)phenyl)-naphtho[2,3-c][1,2,5]selenadiazole, NSeD). The optimized NIR-OLEDs based on pure organic materials without outcoupling demonstrated a strong emission at 700 nm and maximum external quantum efficiency (EQE) of 2.09%, exceeding the theoretical maximum value of 1.28%. Currently, we are also carried out stable NIR-emitting organometal halide perovskites.

Key words：Near-infrared, OLEDs, Iridium complexes, Cell Imaging, Perovskites

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