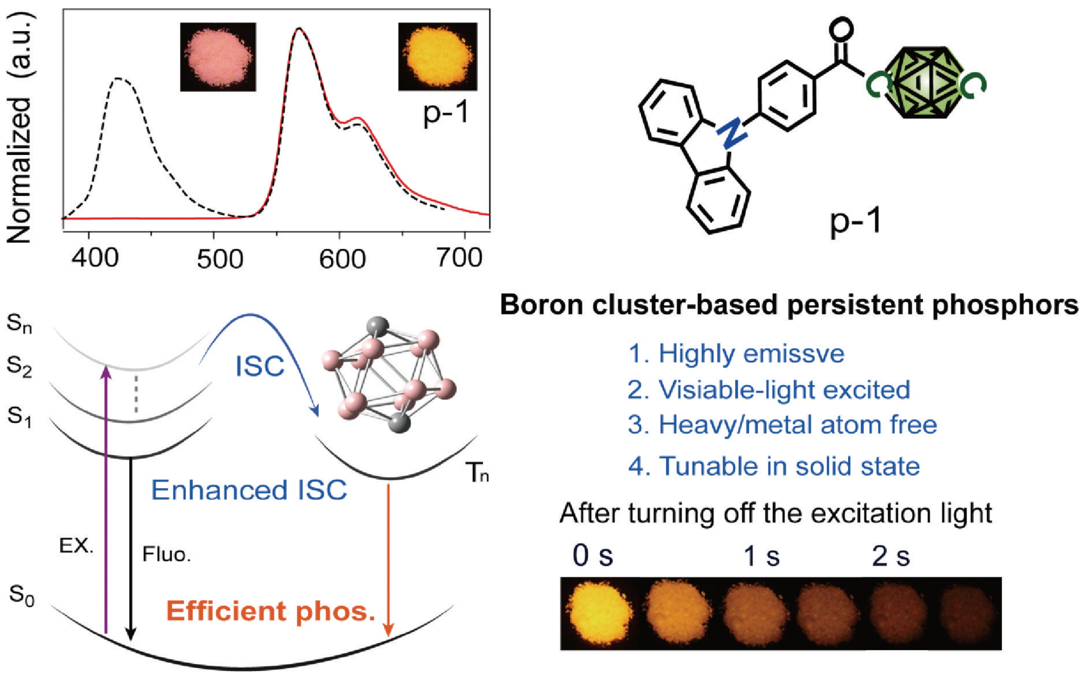
Boron cluster enhanced ultralong organic phosphorescence

With the support by the National Natural Science Foundation of China, the research team led by Prof. Yan Hong (燕红) at the State Key Laboratory of Coordination Chemistry and the Jiangsu Key Laboratory of Advanced Organic Materials, Nanjing University, developed the efficient boron cluster-based phosphors, which was published in *Angew Chem Int Ed* (10.1002/anie.201903920).

Ultralong phosphorescence materials have gained much attention due to the potential applications in decoration, display, anti-counterfeiting and optical recording. However, limited by the slow intersystem crossing rate and/or the facile processes such as vibrational loss and environmental quenching, most ultralong organic phosphorescence materials were organometallic complexes and heavy/metal-atom molecules. In terms of practical applications, these molecules may cause non-negligible heavy-metal toxicity, bad biocompatibility, instability and complicated synthetic conditions. Therefore, high performance metal/heavy-atom free organic molecules are expected, but examples exhibiting excellent properties of ultralong organic phosphorescence have rarely been reported so far.



To address the above issues in organic phosphorescent materials, they proposed a new strategy to realize efficient persistent phosphors through introduction of boron clusters which was found to promote intersystem crossing from singlet to triplet. Moreover, ultralong triplet excitions can be stabilized via multiple non-classical hydrogen bonds such as B—H⋯π interactions. All these devote a long lifetime of up to 0.666 s and an absolute phosphorescence quantum yield of 7.1%. This exhibits excellent luminescence among organic phosphors without heavy atoms. Furthermore, these phosphors can be excited by visible light and show dynamic emission behaviors including thermochromism and mechanochromism. This work demonstrates that non-metal/heavy-atom boron clusters can be used to develop multi-functional and high-performance phosphors which may have potentials for applications in organic optoelectronics, molecular imaging, storage encryption and data security.