EMISSION MECHANISM OF NEXT GENERATION ORGANIC LIGHT-EMITTING MATERIALS

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Unlike conventional fluorescence or phosphorescence materials, next generation organic light-emitting materials can harvest both the first excited singlet (S_1) and first excited triplet (T_1) states for light emission with a nearly 100% of emission efficiency. In particular, materials showing thermally activated delayed fluorescence (TADF), so-called TADF materials or TADF molecules, have attracted considerable attention because TADF materials can be consisted of only light elements, such as H, C, and N, having a potential to reduce a production cost of organic light-emitting diodes (OLEDs). Currently, a synthesis of highly efficient of TADF materials is a serious demand for the development of OLEDs. A lack of understand of the TADF emission mechanism is the bottleneck of the synthesis of TADF molecules. TADF, which is a radiative transition from S1 states produced via *thermally up-conversion* of T_1 state, is generally known to rely on the energy difference between S_1 and T_1. Therefore, control of the energy difference enhances the TADF emission efficiency. However, the actual rate cannot be determined by the energy difference only. This fact suggests an importance of excited-state dynamics for the TADF emission mechanism. Ultrafast time-resolved spectroscopies are powerful tools to study excited-state dynamics of materials. Especially, transient absorption spectroscopies can directly detect time behaviour of both S and T state. In this talk, I give a general introduction of TADF materials and concept of thermal up-conversion of T state. Then, using our ultrafast spectroscopic techniques, I show our recent results of the detail emission mechanism of TADF. Our results aid in designing highly efficient TADF materials.

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