

Direct Observation of Triplet Exciton energy transfer process in Lead Halide quasi-2D Perovskite Structure via Room-temperature Phosphorescence

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To develop hybrid organic-inorganic perovskite materials for optoelectronics, understanding mechanism of photophysical process is important. For this investigation, we synthesized conjugated ammonium cation with alkylammonium cation substituted on aromatic ring. These cations are introduced to Ruddlesden-Popper type and quasi-2D lead halide perovskite materials in thin film forms.

In these films, we observed the conjugated aromatic cations doped into layered perovskite lattice by X-ray diffraction and Fourier-transform infrared spectra. By measuring photophysical properties, the films showed photoluminescence spectra that has large Stokes-shift and specific vibrational state. Also, the large Stokes-shift emission has very slow decay until millisecond range. The emission result from phosphorescence of the aromatic organic cation although only organic cation thin film emitted small Stokes shift and non-specific vibrational spectra compared to perovskite film. This phenomenon is an example that triplet state electrons of lead halide perovskite involves in photophysical process.