CYANOPYRIDINE-BASED TADF EMITTERS FOR OLEDS AND OPTICAL SENSING

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The technology of organic light emitting diodes (OLEDs) is rapidly growing. The main option to increase the efficiency of the devices is to effectively utilize triplet excitons in electroluminescence. Conventional phosphorescent OLEDs require the use of earth-rare metal complexes such as those of Ir, Pt, Au, etc. incorporated in the organic matrixes (hosts) [1]. Emitters exhibiting thermally activated delayed fluorescence (TADF) emerged as a cost-effective alternative to phosphorescent emitters [2]. TADF is a long-lived fluorescence based on upconversion of triplet excitons into singlet ones. Here, we report on the series of cyanopyridine derivatives as TADF emitters. The ionization energies estimated from the photoelectron emission spectra are in the range of 5.37-5.86 eV. Drift mobility of the charge carriers of the compounds measured by the techniques of time-of-flight and charge extraction by linear increase of voltage were evaluated to be up to 1×10^{-3} $cm^2/V{\cdot}s$ at an electric field of approximately 2.5×10^5 V/cm. TADF was detected for the toluene solutions of the compounds. Picric acid was added to the deoxygenated toluene solution of one of the compounds to test the sensitivity of its emission to the nitroaromatic explosive compound. The Stern-Volmer plot showed a linear correlation with the photoluminescence lifetime of the sample. The increase of the picric acid concentration to 20% resulted in the 5.8-fold decrease of the TADF lifetime of the solution. The emission peaks shifted from blue to green/yellow spectral regions for most of the compounds when they were molecularly dispersed in host 1,3-bis(N-carbazolyl)benzene. The photoluminescence and electroluminescence lifetimes of up to 0.5 ms were recorded. The thermal activation of TADF was confirmed from the analysis of photoluminescence decay curves recorded at the different temperatures. The fabricated OLEDs showed the external quantum efficiency of up to 30.6%.

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