Dual-Mode Phosphorescence in Gold(I) Complexes with Monosubstituted *N*-Heterocyclic Carbene Ligands

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Luminescent functional materials have been explored for their properties and their vast range of applications in light emitting devices. The luminescence quenching in the aggregated phase of organic luminophores poses problems to the practical applications. This concentration quenching issue was resolved after the pioneering work of Tang *et al.* in 2001, where strong luminescence in hexaphenylsilole on aggregation was reported, showing Aggregation Induced Emission (AIE) behavior.[1] Following this discovery, thorough research on AIE-active materials have been conducted. Gold (I) complexes are reported as AIE-active materials and their optical properties depend strongly on the aggregated structures and the ability of forming aurophilic interactions. The luminescence in these complexes can be controlled by careful selection of ligands.[2]

This work reports Au(I) complexes with N-heterocyclic Carbene ligands bearing different substitutions on the benzimidazole rings. Incorporating different alkoxy chains influences the aggregated structure, resulting in distinct luminescence behavior. The monosubstituted complex **1** with hexyloxy chain showed a dual-mode emission comprising of prompt blue and delayed green emission, shown in figure 1. Similarly, complex **2** showed a strong green emission along with small peaks corresponding to blue emission, depicted in figure 2. The luminescence analyzed at different temperatures revealed temperature-dependent luminescence color changes. In summary, this study demonstrates the tunability of the optical properties by careful selection of ligands to influence the aggregated structure.

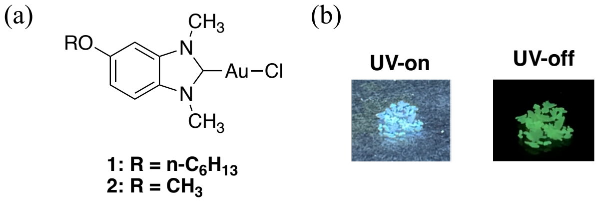

Figure 1. (a) Molecular design of the complexes, (b) Dual emission of complex **1**.

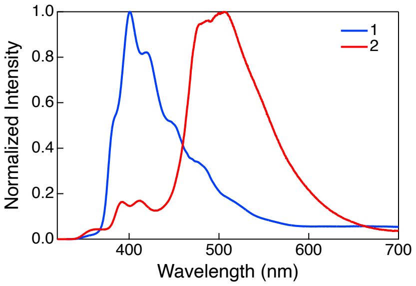

Figure 2. Emission spectra of **1** and **2** in crystal ($\lambda_{ex} = 325$ nm).

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