

Ir^{III}-Au^I Bimetallic Complexes: A New Pathway for Advanced Photoluminescent Materials

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The synthesis of luminescent bimetallic complexes is a growing area in photonics and materials science.[1] These complexes often exhibit exceptional luminescence due to the interactions between metal centers linked by a bridge, each component designed for a specific function. Combining Ir^{III}-based complexes with Au^I centers has attracted significant attention due to its promising applications in catalysis [2] and biomedicine [3]. In this context, we synthesized a novel Ir^{III}-Au^I photoluminescent complex, [(ppz)₂Ir(μ-bbip)AuBr]PF₆, using 1,3-dibenzyl-1H-imidazo[4,5-f][1,10]phenanthroline-3-ium bromide (bbip) as a bridging N-heterocyclic carbene (NHC) ligand. The complex was fully characterized by various spectroscopic and analytical techniques, with its structure confirmed via X-ray diffraction, validating the proposed formulation and coordination sphere. For comparison, a monometallic Ir^{III} complex with bbip, [Ir(ppz)₂(bbip)](PF₆)₂, was synthesized, characterized, and its structure also confirmed by X-ray diffraction. Both complexes exhibited broad excitation bands across the UV-Vis region. They emitted orange to red light in all tested solvents, with the emission of the Ir^{III} complex being more sensitive to different solvents. The coordination of Au^I to bbip induced a slight blue-shift in the emission spectra across solvents. Furthermore, a significant increase in both the lifetime (τ - from 278 ns to 554 ns in degassed DCM) and quantum yield (Φ - from 24% to 61% in degassed DCM) was observed in most solutions. These findings demonstrate that the Ir^{III}-Au^I interaction in bimetallic complexes enhances photoluminescent properties, offering potential for the development of advanced luminescent materials.

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