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Synthesis and Characterization of Copper(I) Complexes Bearing Diphosphanes and Multifunctional Carboxylates as Ligands †

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Abstract: Over the last decade, organic light-emitting diodes (OLEDs) technology has attracted much scientific interest due to its applications in optoelectronic devices, such as artificial lighting. OLED devices currently in use frequently utilize phosphorescent complexes of the platinum group metals as emitting materials. An alternative type of emitting materials for high-performance OLEDs is based on luminescent copper(I) complexes, many of which have been proved to exhibit very high emission efficiencies, such as some mononuclear [Cu(PP)(NN)] + complexes with chelating diphosphine (PP) and pyridine-based diimine (NN) ligands. Moreover, these compounds are based on a high-abundant, low-cost, and environmentally benign metal. The photophysical emission characteristics of luminescent copper(I) complexes show a strong dependence on the type of donor atoms of their ligands, as well as on the coordination geometry of the metal center and their nuclearity. In this context, herein, we present the synthesis and characterization of a series of photoluminescent copper(I) compound bearing as ligands combinations of the diphosphine 1,1-bis(diphenylphosphino)methane or dppm with anions of various polytopic carboxylates. The molecular structures of these compounds were determined by single-crystal X-ray crystallography, which revealed that they are cationic polynuclear complexes based on $[(\mu_2$ -dppm)$Cu_2]^{2+}$ bimetallic units bridged by different polytopic carboxylates, each one exhibiting different coordination modes. Solid-state emission spectroscopy studies of the complexes revealed their strongly luminescent character, showing emission wavelength maxima in the 470-510 nm wavelength region. It is worth noting the effect of the nature of the bridging carboxylate as well as the presence of metallophilic interactions on the emission characteristics of the compounds, which suggest their involvement in the lower energy emitting excited states of the complexes. These preliminary results provide great insight for further expanding this class of photoluminescent compounds and studying their emission properties thoroughly to develop novel strongly luminescent copper(I)-based emitting materials.

Keywords: OLES; copper complexes; diphosphines; multifunctional carboxylates; crystal structures; fluorescent spectroscopy.

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Conflicts of Interest

The authors declare no conflict of interest.