Cuprophilic or not? The potential importance of Cu-Cu interactions for photoactive Cu(I) complexes...and beyond

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Transition metal complexes as photoactive materials for OLEDs, solar cells and photo-catalysis are a very active field of research, which has mainly been focussed on d^6 and d^8 complexes of the heavy transition metals Ru, Ir and Pt.[1] This is due to their strong spin-orbit coupling (SOC), leading to long-lived triplet excited states and phosphorescence, which can increase the efficiency of OLEDs by a factor of four. Also, the different redox potentials and reactivity of the triplet states in comparison to the singlet excited state are of great interest.

Very recently, Cu(I) compounds have proven to be viable alternatives, as their d^{10} configuration inhibits the problematic non-radiative decay of the triplet states *via* metal-centred d-d*-transitions in d^6-Ir(III) and d^8-Pt(II) complexes.[2] Furthermore, d^{10}-Cu(I) compounds can exhibit metallophilic interactions, similar to aurophilic interactions, although much weaker.[3]

In this talk we will give an overview of our progress on using such cuprophilic interactions as a design motif to greatly enhance the radiative rate constants for singlet and triplet excited state emission in Cu(I) NHC-picolyl complexes,[4] for mechanochromic luminescence of dicopper(I) NHC compounds,[5] as well as demonstrate their role in transmetalation reactions in cuprates.[6]

In addition, we will discuss the importance of the specific ligand structure for efficient triplet state formation,[7] and show the synthesis, structure and surprising photophysical properties of Cu(I) complexes bearing new pi-chromophore ligands such as phosphinines,[8] diborenes [9] and phenylpyridine[10].

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