New Multispin Phosphorescent Chromophores

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Square-planar (bpy)Pt(bdt) (bdt = benzene-1,2-dithiol; bpy = 4-4' bipyridine) Donor-Acceptor (D-A) complexes are of interest due to the remarkable nature of their lowest energy bdt → bpy ligand-to-ligand charge transfer (LL'CT) excited states. The nature of this LL'CT transition results in the formation of a charge separated open shell singlet biradical excited state. These complexes readily intersystem cross (ISC) to the open shell triplet configuration with long-lived excited state lifetimes and observed photoluminescence. We have been interested in the effects of radical elaboration on the ISC rates and excited state lifetimes of LL'CT complexes. As such, we have synthesized a new verdazyl (Vdz) radical elaborated (bpy)Pt(bdt-Vdz) complex and performed spectroscopic and computational studies on this interesting system. Phosphorescent emission has been observed on this complex indicating the existence of a long-lived excited state with a different spin multiplicity (S = 3/2) than that of the electronic ground state (S = 1/2). The results are discussed in terms of the excited state electronic structure, nature of the excited state magnetic exchange interactions, and the potential for generating spin polarized excited states that will contribute to dynamic spin polarization effects in the ground state.

Key words: Platinum donor-acceptor complexes, verdazyl radical, exchange interactions