Dinuclear transition metal complexes and their application as triplet photosensitisers for TTA upconversion and Photodynamic Therapy

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Triplet photosensitisers (PSs) have potential applications in photovoltaics, photocatalysis, photodynamic therapy and bioimaging.[1] They have a vital role in Triplet-Triplet Annihilation (TTA) upconversion, a process through which to convert low energy photons to high energy photons. Most heavy transition metal complexes show efficient Inter-System Crossing (ISC), however many transition metal PSs have a small molar absorption coefficient in the visible region and possess short triplet excited state lifetimes.[2,3] In an attempt to address these shortcomings, this work investigates a series of dinuclear bipyridyl Ru(II) and cyclometalated Ir(III) complexes. These contain Boron-dipyrromethene (BODIPY) and carbazole linkers as bridging chromophores. In the two series, the dinuclear complexes show enhanced and bathochromically shifted absorption in the visible region compared to their mononuclear analogues and their upconversion quantum yields are significantly improved. The presence of a triplet energy equilibrium is proposed as responsible for particularly extended triplet excited state lifetimes (>1000 μs). The BODIPY bridged dinuclear ruthenium complex gave attractive and positive results on Photodynamic Therapy (PDT) testing.[4]

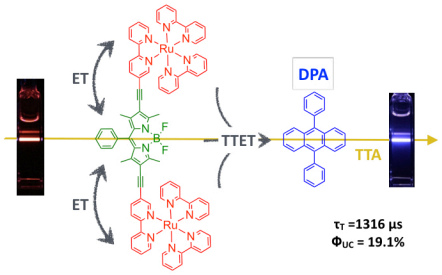

Figure 1. Process of TTA upconversion in the mixture of BODIPY bridged ruthenium dinuclear complex (donor) and DPA (acceptor), excited at 589 nm.

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