

Research Student Project

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Funding Arrangements	Fully Funded
Subject Area	Organic Chemistry, Materials chemistry, Photochemistry
Title of the Project	Heavy-atom-free photosensitizing materials
<p>Project Description</p> <p>Background This project aims to develop a new type of hybrid materials generating long-living triplet excited states for photonic applications. Current approach in the design of such materials relies on using heavy metal complexes and halogenated organic compounds which often require tedious synthesis, possess increased cost, low solubility and high toxicity. An alternative strategy, which will be applied in the project, is a generation of triplet excited states from charge-transfer (CT) states in heavy-atom-free molecules through spin-orbit charge transfer intersystem crossing (SOCT-ISC). This phenomenon has recently been reported for various electron donor-acceptor dyads and attracted significant attention. In this project, solid materials based on corresponding photoactive molecules will be synthesized, studied and optimized to provide a step-change in practical application of the SOCT-ISC process. Lead materials, efficiently forming triplet excited states under visible light irradiation, will be evaluated as photocatalysts for organic transformations, photoactive components of antibacterial coatings and as photosensitizers for the triplet-triplet annihilation photon upconversion (TTA-UC) process. Ultimately this work may lead to advanced materials for healthcare and new generation of solar cells with improved energy harvesting profiles.</p> <p>Aims and methods In the first 1.5-2 years the student will be developing the synthesis of organic building blocks, studying their photophysical properties and performing materials synthesis. It will include a collaborative work using advanced optical spectroscopic techniques to investigate the excited state properties. Optimization of the performance of novel materials in target applications is the focus of the third year.</p> <p>Training The student will receive training in advanced organic synthesis, electrochemistry, optical spectroscopy (UV-Vis-NIR absorption, steady-state and time resolved emission, flash photolysis), with exposure to DFT computational modeling. The student will have access to various TU Dublin training programs to support the development of scientific, transferable and employability skills.</p> <p>Student requirements for this project</p> <ul style="list-style-type: none"> • desire to discovering new knowledge, genuine interest in chemistry and strong competence of organic chemistry • training and/or laboratory experience in organic synthesis • creativity and ability to work with a high degree of independence • good interpersonal and collaborative skills 	