

Novel Methods in Photochemistry and Photocatalysis

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In this presentation I will highlight recent work from my group focused on the use of photochemistry and photocatalysis to aid the synthesis of high-value molecules. The presentation will focus on:

Boryl radical reactivity. Amine-ligated boryl radicals are highly reactive open-shell intermediates with significant potential for the synthesis of borylated materials. In this presentation, I will highlight the use of these species for the C(sp²)-H borylation of azines (e.g., pyridine, quinoline) at positions that are inaccessible via conventional C-H activation methods.[1] Additionally, I will discuss their reactivity with alkenes to form sp³-hybridized materials.[2] These unique reactivities have led to the development of novel, stable borylated materials with a strong capacity to participate in Suzuki-Miyaura cross-coupling reactions. Furthermore, I will present our recent work demonstrating the ability of amine-ligated boryl radicals to activate organic halides via halogen-atom transfer (XAT), and how this strategy can be integrated with nickel and copper catalysis for broader couplings involving aryl halides, aryl boronic acids, and amides.[3]

Photoexcited nitroarenes. Nitroaromatics are widely available feedstocks that are routinely used for the preparation of anilines upon reduction. I will present our most recent work that demonstrates how these species can be used, upon blue light irradiation, to promote the ozonolysis-style cleave of olefins[4] and also allow preparation of complex and highly functionalised saturated heterocycles.[5] Furthermore, I will present our recent work where modulation of the excited configuration of these species has enabled the currently elusive ozonolysis of aromatics in the presence of olefins.

Reference

- [1] *Nature* **2021**, 595, 577.
- [2] *J. Am. Chem. Soc.* **2024**, 146, 24042.
- [3] *Nat. Synth.* **2024**, asap. & *J. Am. Chem. Soc.* **2024**, 146, 22423.
- [4] *Nature* **2022**, 610, 81.
- [5] *Nat. Chem.* **2024**, 16, 771 & *J. Am. Chem. Soc.* **2023**, 150, 27810.



Short CV: Daniele is currently a W3 Professor and Chair of Organic Chemistry at the Institute of Organic Chemistry, RWTH Aachen University. His research field of interest is the development of novel chemical processes exploiting the reactivity of excited-state species and radical intermediates. He started his professional career as Lecturer (2014-2018) then Reader (2018-2020) and then Professor (2020-2022) at the University of Manchester, after a Research Officer position at the University of Bristol. He received the Ph.D. from the Department of Chemistry at the University of Sheffield (UK) in 2010. He has received various awards such as the Philip Leverhulm Prize, the Harrison-Meldola Memorial Award and the AstraZeneca Award for Outstanding Achievement in Organic Chemistry.