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International Year of Light and Light-Based Technologies

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The UN General Assembly recognised the importance of light and its applications in our daily lives and proclaimed 2015 as the International Year of Light and Light-Based Technologies (IYL 2015).[1] The International Year of Light celebrates light sciences to provide awareness on how light can promote sustainable development and provide solutions to current and future challenges. Light is a truly multidisciplinary area in science and finds applications in chemistry, physics, medicine, and energy (among others).

This special issue highlights achievements in research from across the globe in photochemistry, where light induces chemical reactions, and photophysics, where light interacts with matter to luminesce and/or convert to energy, for the sustainable production of medicines and the advancement of modern technology.

Light often allows for the synthesis of complex target compounds under sustainable conditions with the 'flick of a switch'. Photochemistry has thus enriched the synthetic chemistry portfolio. Selected applications of TiO_2 photocatalysis in organic synthesis are reviewed by Norbert Hoffmann.[2] Eietsu Hasegawa and Shin-ya Takizawa highlight examples of 2-aryl-1,3-dimethylbenzimidazolines as effective electron and hydrogen donors in photoinduced electron-transfer reactions.[3] In a subsequent paper, Hasegawa and co-workers utilise these compounds for the visible light-promoted metal-free reduction of organohalides.[4] The area of continuous-flow photochemistry continues to grow with three contributions in this special issue. Sunlight-induced benzylic brominations are successfully realised in a capillary microreactor by Chan Pil Park and co-workers.[5] Shinichiro Fuse and colleagues demonstrate an efficient multistep Arndt–Eistert synthesis in a microflow system without isolation of intermediates.[6] Photodecarboxylative benzylations are successfully optimised by Michael Oelgemöller and co-workers under batch conditions and subsequently transferred to an advance continuous-flow photoreactor module.[7] Yasuharu Yoshimi and his group utilise photodecarboxylations for the generation of carbanions, which are subsequently trapped by benzaldehyde.[8] Unusual molecular architectures are realised by Andrei Kutateladze and co-workers via intramolecular cycloadditions of photogenerated azaxylylenes.[9] Thorsten Bach's team performs enantioselective photorearrangements of spirooxindole epoxides catalysed by a chiral bifunctional xanthone and obtains the corresponding products in high yields and moderate enantioselectivities.[10] Likewise, Tadashi Mori and colleagues examine the effect of environmental and experimental factors on the diastereoselectivities of the Paternó–Büchi reaction of chiral cyanobenzoate.[11]

Light can also be used to generate and study reactive intermediates. Manabu Abe and co-workers are able to simultaneously observe triplet and singlet cyclopentane-1,3-diyl diradicals.[12] The formation and direct detection of a

Associate Professor Michael Oelgemöller received his Diploma from the University of Münster in 1995 and his Ph.D. in organic photochemistry from the University of Cologne in 1999. Michael was a researcher at the ERATO-JST Photochirogenesis project in Osaka (1999–2001) and at Bayer CropScience K. K. Japan in Yuki (2001–2004). From 2004 to 2008, he held a position as a lecturer in organic and medicinal chemistry at Dublin City University. In February 2009, he joined James Cook University in Townsville as an associate professor in organic chemistry, where he leads the Applied and Green Photochemistry Research Group.[13] The activities of the group are truly multidisciplinary and range from the development of miniaturised early drug discovery tools to the solar manufacturing of chemicals, photochemical synthesis of bioactive compounds, photostability testing, and photochemical degradation of organic pollutants. Michael has received several awards and has been a visiting professor at various universities in Asia and Europe.

Dr George Vamvounis obtained his Ph.D. in polymer chemistry from Simon Fraser University in 2005. This was followed by post-doctoral positions at the Royal Institute of Technology (Sweden) and The University of Queensland and he has held prestigious fellowships from Canada (NSERC-IPS Fellowship), Sweden (Kami Post-Doctoral Fellowship) and Australia (ARC Australian Research Fellow). Currently, George is a senior lecturer in physical chemistry at James Cook University, with a research focus on polymeric and photoswitchable materials for the next generation of optoelectronic devices.

non-conjugated triplet 1,2-biradical is furthermore described by Anna Gudmundsdottir and her group.[14] Rosalie Hocking and co-workers describe the structural effects of sodium birnessite-based films to improve solar fuel technology.[15] George Vamvounis and Nicholas Sandery explore the use of photochromic compounds as colorimetric sensors for trinitrotoluene-based explosives.[16]

Photophysics of materials is important for the development of new technologies such as light-emitting devices (LEDs), which convert electrical energy into light. The production of efficient LEDs is underpinned by the development of new solid-state phosphorescent materials. To that end, Florian Baur and Thomas Jüstel report the effect of host materials of new lanthanide-based red phosphors on the phosphorescence efficiency.[17] Furthermore, Peter Junk, Ulrich Kynast, and co-workers discuss the important solid-state luminescence of rare earth diclofenac complexes.[18]

Photovoltaic cells convert light energy into electrical energy and discovery of new materials for the production of efficient solar cells is important to break free from the dependency on non-renewable energy sources. Rapid advances in polymer solar cell efficiency have been made in recent years through the fundamental understanding of the structure–property relationships of light-absorbing polymers. To that end, Yuning Li, Hany Aziz, and their team report the effect of vertical and lateral charge transport properties in a diketopyrrolopyrrole-based polymer, which is important in solar cell performance.[19] Tim Bender and co-workers describe novel light-absorbing aryl-substituted boron subphthalocyanines.[20] Seth Rasmussen and colleagues report the influence of side chains and spacer units in light-absorbing thieno[3,4-*b*]pyrazine-flourene copolymers,[21] and David Lewis et al. describe the effect of fullerene content in polymers.[22] Kenneth Ghiggino and his team report a new light-absorbing copolymer based on benzodithiophene and [3,4-*c*]pyrrole-4,6-dione.[23] Finally, Hongxia Wang and co-workers describe the burgeoning popularity of perovskite solar cells based on nanocrystalline SnO_2.[24]

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