Chemical Photocatalysis: Organic Synthesis with Visible Light

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Sensitized photochemistry evolved over the last 20 years into an enabling technology for the synthesis of complex organic molecules due to new mechanistic concepts and advances in light sources.[1] The use of visible light and dual catalytic systems allow now challenging transformations with good selectivity under mild reaction conditions.[2] Although light is an ideal reagent for chemistry (cheap, safe, can be used in large excess) it comes with certain limitations:

1. Compared to chemical bond energies, the energy of a visible light photon is small and photocatalytic activation of stronger bonds therefore requires special strategies.[3]
2. Photoinduced electron transfer leads to radical ions or combined with proton transfer to radicals, but the majority of chemical reactions proceeds via ionic intermediates. How can we generate reactive anions by light?[4]
3. Metal complexes and organic dyes are widely used as molecular photocatalysts in synthesis, but their stability and reuse can be problematic. Organic semiconductors are a valid alternative, particular for applications at larger scale.[5]

The lecture discusses approaches from our laboratory to overcome these and other current and future challenges in chemical photocatalysis.

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***Burkhard König**, born 1963 in Wiesbaden, received his doctorate in 1991 from the University of Hamburg under the direction of Prof. de Meijere. He continued his scientific education as a postdoctoral fellow with Prof. M. A. Bennett, Research School of Chemistry, Australian National University, Canberra, and Prof. B. M. Trost, Stanford University. In 1996 he obtained his habilitation at the University of Braunschweig. Since 1999 he is full professor of organic chemistry at the University of Regensburg. He was a dean of the Faculty of Chemistry and Pharmacy at the same university (2011-2015), Member of the executive board of the German Chemical Society (2004-2007), Chairman of the Liebig Vereinigung (National organic division; 2008 – 2012). He is a member of the advisory boards of Chem. Eur. J. (since 2014), Eur. J. Org. Chem (since 2014, Chair). and editor of the Science of Syntheses reference volume on photocatalysis. He was recognized with several awards and distinctions e.g., ERC Advanced Grant (2016), Highly cited researcher (2021, Clarivate), Chemistry Europe Fellow (2019), Reinhard-Koselleck grant of the DFG (2017), UN-Decade Award on Sustainability (2011/2012), Literature award of the Fonds of the German Chemical Industry (2007), Invitation fellowship award of the Japan Society for the Promotion of Science (1996), award of the Dr. Otto Röhm Gedächnisstiftung (1995). He is an author of more than 550 papers and reviews, 60 book reviews and science related articles (H-index 78 (Scopus), 86 (Google Scholar)). His current research interests focus on the development of synthetic receptors for the recognition of biological target structures and the application of visible light chemical photocatalysis for organic synthesis.*

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