Young Career Focus: Professor Saihu Liao (Fuzhou University, P. R. of China)

Background and Purpose. SYNFORM regularly meets young up-and-coming researchers who are performing exceptionally well in the arena of organic chemistry and related fields of research, in order to introduce them to the readership. This Young Career Focus presents Professor Saihu Liao (Fuzhou University, P. R. of China).

Biographical Sketch

Prof. S. Liao

Saihu Liao studied chemistry at Huazhong University of Science and Technology (HUST, P. R. China), and obtained his bachelor's degree in 2005. After two years of graduate studies at the same university in Prof. Yuefa Gong's group, he moved to Germany and joined Prof. Benjamin List's group at the Max-Planck-Institut für Kohlenforschung (MPI-KOFO) in Mülheim an der Ruhr as a PhD student, where he focused on the ion-pair catalyst development based on the concept of asymmetric counteranion-directed catalysis (ACDC) and obtained his doctoral degree in organic chemistry in 2011. Then, he returned to China and joined Prof. Yong Tang's group as a research associate at the Shanghai Institute of Organic Chemistry (SIOC), Chinese Academy of Sciences, where he got to learn some chemistry about olefin polymerization. After another stay at MPI-KOFO from 2013 to 2016 as a postdoctoral researcher concentrating on new organocatalytic activation mode development, he started his independent career at Fuzhou University (P. R. China) in September 2016, where he was promoted to full professor in 2017. Now, he is also the Director of the Key Laboratory of Molecule Synthesis and Function Discovery of Fujian Province Universities. His current research interests encompass organocatalytic polymerization, photo-controlled polymerization, and sulfur radical chemistry. He was the recipient of the "Minjiang" Distinguished Professorship in 2016, was elected into the Recruitment Program of Global Experts of China in 2017, the Hundred-Talent Plan of Fujian Province in 2018, and received the Thieme Chemistry Journals Awards in 2022.

INTERVIEW

SYNFORM *What is the focus of your current research activity?*

Prof. S. Liao The goal of our research is to develop efficient, practical, and sustainable methodologies for polymer synthesis with precise controls and functions. We are particularly interested in the development of organocatalysts, including organic photocatalysts and chiral catalysts, to achieve sequential, spatiotemporal, and stereochemical controls over different types of polymerizations. Additionally, we are also interested in the development of organic reactions involving sulfur and fluorine, targeting reagent, initiator, and monomer synthesis.

SYNFORM *When did you get interested in synthesis?*

Prof. S. Liao I was attracted by synthesis in my undergraduate course of organic chemistry and became particularly interested in the rules and mechanisms behind different reactivities. This curiosity later on led me to Prof. Yuefa Gong's physical organic chemistry course for graduate students and to choosing organic chemistry for my Master's studies. During that time, I was fascinated by the potential and versatility of organocatalysis, and luckily got the chance to pursue doctoral studies in the group of Prof. Benjamin List at the Max-Planck-Institut für Kohlenforschung (MPI-KOFO) in Germany, where I enjoyed the development of catalysts and reactions based on different concepts. I became interested in polymer synthesis when I was in Prof. Yong Tang's group, where I was impressed by the work on structural control on polyethylene through catalyst and ligand design. Later, I spent another stay in MPI-KOFO, where I finally made the decision to work on organocatalytic polymerization for my independent research.

SYNFORM *What do you think about the modern role and prospects of organic synthesis?*

Prof. S. Liao As a pivotal approach in constructing matter, organic synthesis is a fundamental science, affording the molecular basis for various research and applications. Nature does a similar thing in building up the body from elements and small molecules, at a miraculous level of precision and control. In this regard, I always expect problem- and function-oriented breakthroughs from organic synthesis to tackle those important issues that are currently challenging us.

SYNFORM *Could you tell us more about your group's areas of research and your aims?*

Prof. S. Liao Inspired by Nature, and also by the Chinese philosophy of Tai Chi (Taiji) and Yin-Yang, I am particularly interested in the control of balance and equilibrium in bond formation and breakage, as well as the limitations of that control. During the time of setting up the platform for polymer chemistry study, we focused more on photo-induced radical reaction development, aiming to develop some new methods for initiator and monomer synthesis. In this regard, we developed a thioamide-type of radical thiolating agent for radical decarboxylative thiolation to free thiols (*Nat. Commun.* **2020**, *11*, 5340), which was inspired by the chain-transfer agent design in RAFT polymerizations. Further, we explored the generation and application of fluorosulfonyl radicals, which are challenging to produce due to the strong electron-withdrawing effect of the SO_2F group (*Angew. Chem. Int. Ed.* **2021**, *60*, 3956–3960; *Synlett* **2022**, *33*, 401–408). For the study of polymer chemistry, currently we are focused more on the development of organic photocatalysts, and recently introduced a catalyst design logic based on heteroatom-doping of polycyclic arenes. By following this logic, we have successfully developed both highly reducing (ODA) and oxidizing organic photocatalysts (BPS) via O– and P+ doping of anthanthrene, respectively (Figure 1). The ODA catalysts could promote the metal-free atom transfer radical polymerization (ATRP) of methacrylates at a sub-ppm level of catalyst loading (*Nat. Commun.* **2021**, *12*, 429), while BPS could achieve a strict temporal control in the cationic RAFT polymerization of vinyl ethers (*J. Am. Chem. Soc.* **2021**, *143*, 6357–6362), both by virtue of the successful establishment of an effective activation–deactivation equilibrium.

SYNFORM *What is your most important scientific achievement to date and why?*

Prof. S. Liao Our recently published study on organocatalytic stereoselective cationic polymerization of vinyl ethers (Patent CN 113527556 A, **2021**; *Sci. China Chem.* **2022**, 65, 304–308; *J. Am. Chem. Soc.* **2022**, *144*, 679–684) is something I considered important, as it allows the synthesis of metal-free isotactic poly(vinyl ether)s with high molecular weights and melting points at low catalyst loadings. These poly(vinyl ether)s display tensile properties similar to those of commercial LDPE, but they are more adhesive to polar substrates and, importantly, they are biodegradable. This stereoselective organocatalytic polymerization system was developed based

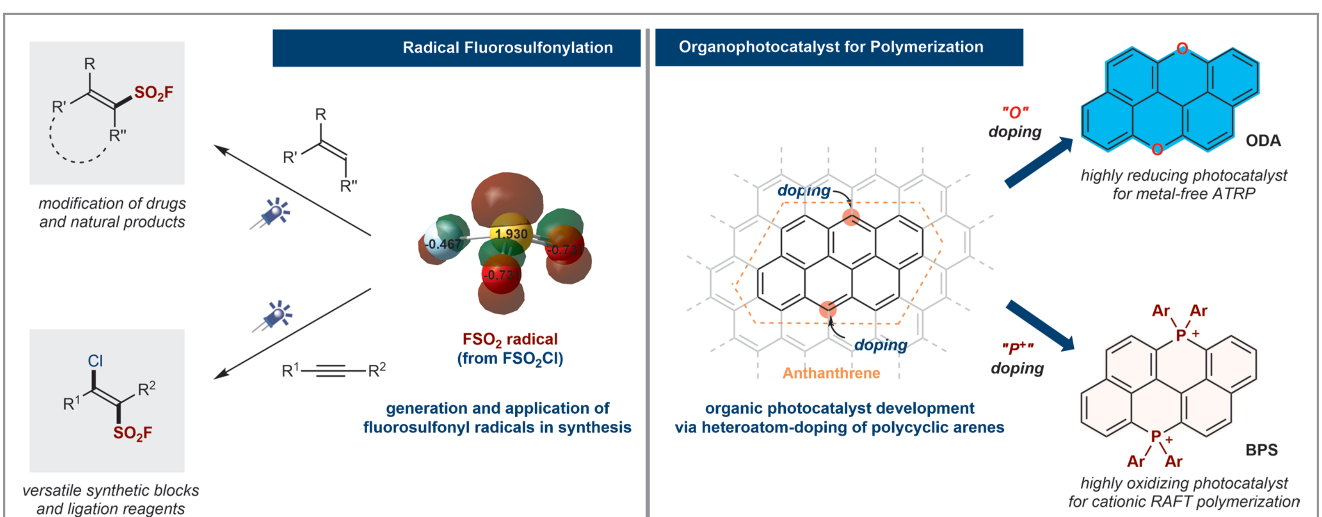

Figure 1 Radical fluorosulfonylation and the development of photoredox organocatalysts for polymerization.

on the concept of chiral counteranion mediation, which may serve as an inspiration for the development of other cationic polymerizations when seeking a tacticity control.

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