The Photopolymer Science and Technology Award

The Photopolymer Science and Technology Award No. 182200, the Best Paper Award 2018, was presented to Chen-Gang Wang, Feifei Li, and Atsushi Goto (Division of Chemistry and Biological Chemistry, School of Physical and Mathematical Sciences, Nanyang Technological University) for their outstanding contribution published in Journal of Photopolymer Science and Technology, 30, (2017) 379–383, entitled “Photo-Controlled Organocatalyzed Living Radical Polymerization and Its Application to Polymer Brush Synthesis on Surface”.

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Living radical polymerization (LRP) is a useful technique for tailoring polymer structures with predictable molecular weights and narrow molecular weight distributions [1,2]. In addition to thermal heating, photo irradiation has extensively been utilized to control LRP [3-22]. The photo reactions do not require heat and are therefore applicable to functional groups and materials that decompose at high temperatures. A photochemical stimulus is one of the most useful external stimuli that can instantly switch the reactions “on” and “off” at desired timings and can spatially trigger the reactions at specific positions and spaces. The reactions are also selectively inducible in response to the irradiation wavelengths; hence, multiple reactions may be regulated in one pot by simply altering the irradiation wavelength. Because of these advantages, photo-controlled LRP has opened up new intriguing applications.

This paper reports a new family of photo-controlled LRP that the authors have recently developed. The polymerization uses alkyl iodides as initiators and organic molecules as catalysts, which is the first photo-controlled LRP for the use of organic catalysts [23,24]. This polymerization is an ideal on-off switchable system by an external photo stimulus and that the polymerization speed is an ideal on-off switchable system by an external of organic catalysts [23,24]. This polymerization is compatible with various functional monomers, and their block copolymers are obtainable. An advantage of this system is that various organic catalysts with different absorption wavelengths can be utilized, namely, the polymerization can be selectively controlled at desired wavelengths by exploiting appropriate catalysts. The feasible wavelength ranges from 350 nm to 750 nm, covering the whole visible region. This polymerization is compatible with various functional monomers, and their block copolymers are obtainable. An advantage of this system is that no special initiators or metals are used; in addition, the catalysts are commercially available. The facile operation, fine response to wavelength, and applicability to a wide range of polymer designs may be greatly beneficial in various applications. A useful application demonstrated in this paper is the synthesis of polymer brushes on surfaces. The photo polymerization was applied to surface-initiated polymerization, successfully providing concentrated polymer brushes with high surface occupancies and also patterned polymer brushes with the use of photo-masks.

These results were also presented at the International Conference of Photopolymer Science and Technology in 2017. The work on the patterned polymer brushes has recently greatly progressed, providing novel structures of patterned polymer brushes. This progress will be presented at the International Conference of Photopolymer Science and Technology in 2018 [25]. The results presented in this paper provide a new useful family of photo-controlled LRP with unprecedented advantages, and hence deserves the Photopolymer Science and Technology Award.

References
3. For reviews on photo-controlled LRP, see refs 3-5. S. Yamago and Y. Nakamura, Polymer, 54 (2013) 981.


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