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Mechanochemically Self-Immolative Polymers

Polymers are important for humanity from daily life usage to advanced science and technology. Considering the degradation rate of polymers in nature and associated difficulties in recycling monomers by depolymerization, the widespread polymer usage poses a significant environmental hazard generating waste in a linear economy. Thereupon, the widespread use of self-immolative polymers, macromolecules can undergo simultaneous depolymerization with trigger activation, for such applications could be a potential solution to these drawbacks. In this study, our plan is to design mechanochemically active self-immolative polymers for functional materials production. Methodologically, carbamoyloxime scaffolds, have been developed by our research group, applied as mechanophore to trigger two different self-immolation approaches. The first approach is directly triggering the self-immolation of 4-aminobenzylalcohol-based poly-carbamates by the activation of aniline units. On the other hand, the second approach uses an indirect trigger, including base-promoted depolymerization of poly(butyl cyanoacrylate) via mechanochemical activation of organic superbases. By combining the mechanochemical approach with self-immolative polymers, it is aimed to achieve more selective self-immolation and complete depolymerization of polymers following mechanochemical activation. This selective self-immolation potentially render polymers a more sustainable alternative for several fields from material science to biotechnology.

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