Masked Cyanoacrylates Unveiled by Mechanical Force

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Mechanical damage of polymers is often a destructive and irreversible process. However, desirable effects may be achieved by controlling the location of chain cleavage events through careful design and incorporation of mechanically active chemical moieties known as mechanophores. It is possible that mechanophores can be used to generate reactive intermediates that can autopolymerize or cross-link, thus healing mechanically induced damage. Herein we report the generation of reactive cyanoacrylate units from a dicyanocyclobutane mechanophore located near the center of a polymer chain. Because cyanoacrylates (which are used as monomers in the preparation of superglue) autopolymerize, the generated cyanoacrylate-terminated polymers may be useful in self-healing polymers. Sonication studies of polymers with the mechanophore incorporated into the chain center have shown that selective cleavage of the mechanophore occurs. Trapping experiments with an amine-based chromophore support cyanoacrylate formation.