Universal Polymer Crosslinkers:
Synthesis, Structure–Function Relationships and Applications in Materials Science

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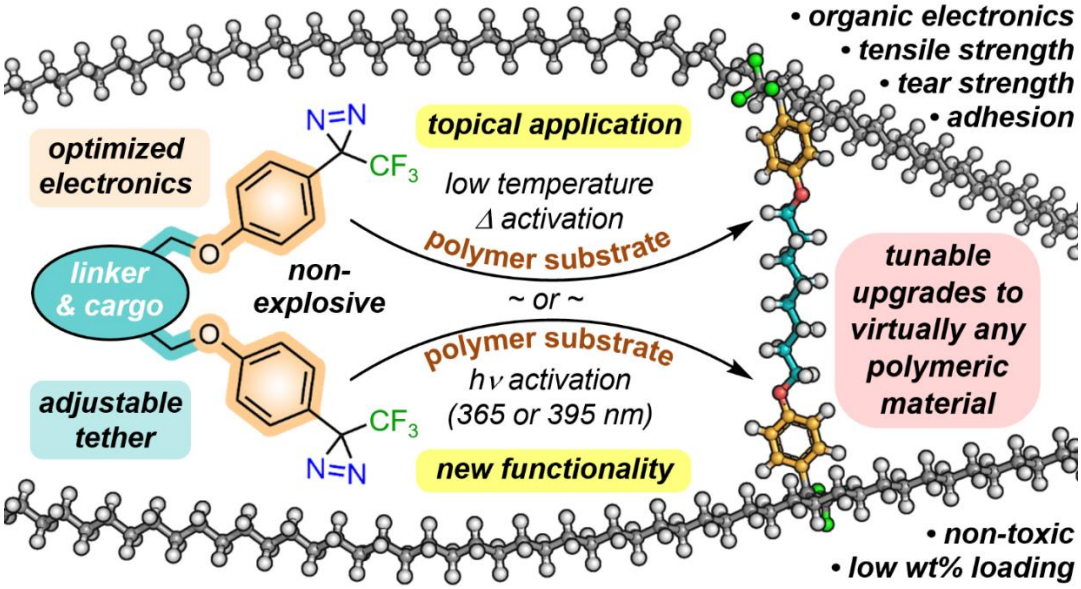
Adding chemical crosslinks between the chains of existing polymer materials provides increased mechanical strength, improved high-temperature performance, and enhanced solvent resistance. *Installing* these crosslinks, however, has historically required the use of distinct chemistry for each type of material: vulcanization for rubber, hydrosilylation for silicone, DMDHEU for cotton, etc.

We developed a family of rationally designed, diazirine-based crosslinker reagents that allow for the on-demand introduction of strong covalent bonds *to virtually any aliphatic polymer material*, through rapid C–H, O–H, and N–H insertion reactions. This presentation will focus on the design, synthesis, and mechanism-driven optimization of this new class of polymer crosslinkers, and will describe several applications, which arise through operationally simple, topical treatment of existing polymer materials. Selected applications may include: (1) adhesion of low surface energy materials, (2) upgrading the mechanical strength of ballistic protective fabric, (3) construction of novel fiber-reinforced UHMWPE–epoxy composites, (4) development of self-sterilizing fabrics, (5) enhancement of the mechanical robustness of omniphobic PDMS coatings, (6) upgrading of perovskite solar cell stability and performance, and (7) photopatterning of electroluminescent quantum dot aggregates for next-generation displays.



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