Abstract Submitted
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Toughening elastomers using mussel-inspired catechol-metal coordination complexes EMMANOUELA FILIPPIDI, THOMAS CHRISTIANI, MEGAN VALENTINE, J. HERBERT WAITE, JACOB ISRAELACHVILI, KOLLBE AHN, Univesity of California, Santa Barbara — Amorphous, covalently-linked elastomers possess excellent reversible extensibility and high failure strain compared to other materials. However, by nature, the large deformability compromises the Young's modulus and the toughness of the elastomer to low values (¡ 2MPa) and imparts brittle fracture. We employ the mussel-inspired strategy of iron-catechol coordination bonding creating dynamic, reversible cross-links in addition to permanent chemical cross-links in an elastomer used in ambient, dry conditions. This simple additional energy dissipative mechanism results in increased modulus and toughness without affecting the network extensibility, which is based on the covalent network. Control of the chain relaxation time scales can be further tuned using the dynamic bonds, imparting mechanical rate dependent properties to the bulk material. The quantitative understanding of the time scales associated with the chain motion versus the metal coordination may provide another simple and independent control parameter in elastomeric material design.

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