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Managing bond tension in spreading macromolecules.[1] SERGEY SHEYKO, University of North Carolina at Chapel Hill, INSUN PARK, UNC Chapel Hill, ALPER NESE, KRZYSZTOF MATYJASZEWSKI, Carnegie Mellon University, DAVID SHIRVANIANTS, MICHAEL RUBINSTEIN, UNC Chapel Hill — Mechanical activation of chemical bonds plays a vital role in biology, chemistry, and engineering. Unlike other activation stimuli, such as light and temperature, mechanical activation is site and direction specific. However, in a typical experiment, macroscopic stress is distributed over myriads of different molecules. This results in significant and ill-defined variation of both the magnitude and direction of forces at individual chemical bonds. Here, we show how to achieve a great degree of control over bond tension in flowing polymer films. The distinctive feature of this finding is that the mechanical tension is controlled on three different length scales. First, chemical bonds are activated within a narrowly defined area of a macroscopic film. Second, only certain molecules are activated within a mixture of molecules. Third, the tension can be focused to a specific bond within a flowing macromolecule. It is demonstrated that the focused tension breaks covalent bonds with a molecular-scale precision.

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