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Crumpling of an Elastic Ring in Two Dimensions CARTER VANHUSS, SHENGFENG CHENG, Department of Physics Macromolecules and Interfaces Institute, Virginia Polytechnic Institute and State University — We use molecular dynamics simulations to study the crumpling of an elastic ring (i.e., a circular elastic line) in two dimensions. The crumpling is triggered by reducing the radius of a circular repulsive wall that is used to confine the ring. The ring is modeled as a bead-spring chain. A harmonic potential describing the bonds between neighboring beads is parameterized to reproduce the Young's modulus of the elastic line in the continuum limit. A modified harmonic angle interaction is used to capture the bending of the elastic line including situations where the line is locally stretched or compressed. We have confirmed that the bead-spring model has the correct continuum limit by comparing results on rings made of different numbers of beads but with parameters derived from the same elastic line. With the computational model, we study the morphological transition of the ring and the local distribution of the bond and bending energies as the ring is compressed at various rates, forced to crumple, and finally confined into a dense-packed structure. We find that the crumpling transition signals a sharp energy transfer from the compression to the bending mode. We further explore the possibility of defining an effective temperature for such crumpled systems.

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