Mechanics of DNA Sticky End Joints

by

Ehsan Ban

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Approved by:

_____
Professor Catalin R. Picu, Thesis Adviser

_____
Professor Assad A. Oberai, Member

_____
Professor Mark S. Shephard, Member

Rensselaer Polytechnic Institute
Troy, New York

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ABSTRACT

Self-assembled DNA structures are promising means of programmed assembly of nanoscale components. For example 3D DNA crystals with sizes of few hundred microns have been self-assembled from single stranded DNA. These crystals have applications in different areas including X-ray crystallography of biomolecules and directed assembly for nanoelectronics. These self-assemblies are held together through molecular configurations similar to DNA sticky ends. Understanding and enhancing the mechanics of DNA sticky ends helps engineer more stable self-assembled structures. In this work, the mechanics of DNA sticky ends is studied by molecular modeling and simulation and by performing uniaxial stretch tests of DNA molecules connected by sticky ends. Sticky ends of different lengths and base sequences are tested. They are divided into two classes: weak and strong sticky ends. The evolution of the macromolecules during stretch and up to failure is studied in detail and a cohesive intermediate complex inhibiting dissociation is identified in the case of the strong sticky ends.