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Statics and dynamics of confined DNA in a nanopit array

ALEXANDER KLOTZ, WALTER REISNER, McGill University, NANOBIOPHYSICS GROUP TEAM — Polymers have been proposed as tools for self-assembly in nanotechnology. There is interest in controlling the movement and conformation of the polymers by modifying the free energy landscape of their environment. It is necessary to understand the free energy and equilibrium behavior of a polymer in a nanoscale environment in order to control its dynamics. In these experiments, DNA molecules are placed in slits on the order of 100 nanometers. The slits are embedded with a lattice of square pits that act as entropic traps for which it is energetically favorable for the DNA to occupy. Based on the geometric properties of the lattice, the molecule in equilibrium will occupy a discrete number of pits. The dynamics of the system can be understood in terms the number of occupied pits. A partition function based on these states can be used to make testable predictions. Measurement of the static conformations of DNA in these pits, as well as the diffusion of the molecule throughout the lattice, as a function of geometric parameters can be used to test models of polymer free energy. Measurements show that the mean occupancy state scales as expected with various pit parameters. Early diffusion results indicate that the diffusion of DNA can be fine tuned by modifying the topography.

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