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Exploring Threaded Intercalation Using Optical Tweezers
THAYAPARAN PARAMANATHAN, MICAH J. MCCAULEY, Department of Physics, Northeastern University, Boston, USA., FREDRIK WESTERLUND, Department of Chemical and Biological Engineering, Chalmers University of Technology, Gothenburg, Sweden, IOULIA ROUZINA, Department of Biochemistry, Molecular Biology, and Biophysics, University of Minnesota, USA, MARK C. WILLIAMS, Department of Physics, Northeastern University, Boston, USA. — Dumbbell-shaped binuclear ruthenium complexes are of interest due to their potential for use in selective chemotherapy. In bulk experiments, these complexes exhibit extremely slow binding kinetics. In contrast, single molecule studies use optical tweezers to stretch the DNA and induce much more rapid intercalation. The observed DNA force-extension curves clearly indicate an increase in DNA melting force and elongation of the DNA molecule upon drug binding, which is evidence of stabilization of the DNA and intercalation of the binuclear ruthenium complex. Hysteresis in the stretching-relaxation curves implies very slow dissociation of these molecules due to threaded intercalation. The concentration profile suggests unusually strong DNA binding affinity for the binuclear complexes compared to simple intercalators.

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