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Measuring and Modeling the Interactions Between DNA-Functionalized Colloids WILLIAM ROGERS, JOHN CROCKER, Department of Chemical and Biomolecular Engineering, University of Pennsylvania — DNA hybridization is an ideal tool to direct "bottom-up" assembly of complex materials and has been used to form crystalline assemblies of quantum dots, polymer microspheres and other materials made exclusively of DNA. In order to fully realize the potential of DNA-directed self-assembly, one must be able to quantitatively predict the binding energies and interaction potentials between the relevant "building blocks." In this work, we use a scanning-line optical tweezers instrument to measure DNA-induced interactions between colloidal microspheres. We then use well-known concepts in statistical mechanics to model the pair-potentials, whose functional form and energetics of binding are intimately related to the equilibrium configurations of grafted polymers and polymer bridges. By measuring and modeling the pair interaction energies as a function of the essential system parameters (solution hybridization free energies, DNA concentrations, temperature, interparticle separation, etc.), we are able to develop simple, numerical tools that can be used to guide both experiment and simulation.

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