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Physical Principles of Virus Templating through Single Molecule Dynamic Force Spectroscopy RAYMOND FRIDDLE, SELIM ELHADJ, GEORGE GILMER, ALEKSANDR NOY, LLNL, JAMES DE YOREO, Molecular Foundry, LBNL — The use of macromolecular scaffolds for hierarchical organization of molecules and materials is a common strategy in living systems that leads to emergent behavior. One characteristic of this strategy is that it generates micron-scale structures from nm-scale building blocks, possessing high-density functionality, defined at angstrom-scales by active sites; a typical example being viral capsids. We are systematically determining the physical variables necessary to consistently pattern virus particles on to nanoscale templates. This presentation will focus on our theoretical and experimental findings regarding our Dynamic force spectroscopy (DFS) measurements; a technique in which fundamental parameters related to interaction potentials can be determined. Here we present a novel theory for determining kinetic desorption rates and equilibrium free energies using DFS in which two well-defined states exist. We compare the results with force spectra measured between individual MS2 virions and chemically modified AFM tips. We also investigate the effects of solution additives, such as PEG, on microscopic kinetics and free energies. Finally, we discuss the relation of single-molecule measurements with the ensemble, and show a connection between the two in the case of bimolecular dissociation.

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