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Selective Adhesion Rate Control of Micron-Scale Objects Using NanoPatterned Surfaces JEFFREY DAVIS, Department of Chemical Engineering, MARIA SANTORE, Department of Polymer Science and Engineering, SURACHATE KALASIN, RANOJOY DUFFADAR, NATALIA KOZLOVA, University of Massachusetts Amherst — Dynamic particle adhesion from flowing solution onto collecting surfaces, heterogeneous at the submicron scale, occurs in important natural scenarios and current technologies. Potential new applications for sensing, separating, and sorting objects in the 200 nm to 5 μm range will stem from our ability to manipulate selectively their dynamic adhesion in flowing conditions. We describe micron-scale particle adhesion from suspensions flowing over surfaces tailored at the 10-50 nm lengthscale. Our collecting surfaces were generally repulsive (electrostatically) towards 500 nm and 1 μm flowing silica particles, but the collectors also contained randomly distributed polymeric or proteinaceous entities that produced spatially fluctuating attractions. With these systems we observed a dependence of the particle capture rate on the density of adhesive groups and, more importantly, an adhesion threshold or lower limit on the feature density that gave rise to a curvature-based selectivity. A semiquantitative fluctuation treatment captures the essential observations, while hydrodynamic simulations also predict the adhesion threshold and particle dynamics near the collecting surfaces.

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