Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Binding kinetics of lock-key colloids: surface diffusion enhancement of the rate of specific binding[1] LAURA COLON-MELENDEZ, DANIEL J. BELTRAN-VILLEGAS, GREG VAN ANDERS, JUN LIU[2], MATTHEW SPELLINGS, University of Michigan - Ann Arbor, STEFANO SACANNA, DAVID J. PINE, New York University, SHARON C. GLOTZER, RONALD G. LARSON, MICHAEL J. SOLOMON, University of Michigan - Ann Arbor — The kinetics of anisotropic particle assembly are expected to be slow due to specific directional interactions between the assembly building blocks. We investigate the lock-and-key colloidal system (Sacanna et al, Nature 464, 575-578 (2010)), to identify and understand the mechanisms that lead to specific lock-key pair binding. For lock pockets of a particular shape, we experimentally identify the importance of nonspecific lock-key binding as a pathway to specific lock-key pair formation. In this pathway, key particles can diffuse on the surface of the lock and bind specifically to the dimple of the lock. We find that this mechanism can be more important to specific bond formation than the direct binding mechanism. We model the surface diffusion mechanism as a mean first-passage time problem. Using an anisotropic interaction potential between a lock and key particle pair (van Anders et al, arXiv:1309.1187), we compare Stokesian dynamics simulations of lock and key binding to the experiments. We propose that nonspecific interactions can play an important role in accelerating anisotropic particle assembly.

[1]This work is supported by the U.S. Army Research Office under Grant Award W911NF-10-1-0518.
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Date submitted: 15 Nov 2013 Electronic form version 1.4