Rostislav Boltyanskiy, Sebastian Villareal
Advisers: Dr. Stuart Rice, Dr. Binhua Lin

Jamming of a Binary Colloidal System in Quasi-2d Geometries

Abstract

This study explored the phenomenon of jamming of a binary colloidal system (silica spheres in water) constrained in quasi-2d grooves as a function of sphere packing fraction. Jamming is a term usually applied to granular and colloidal materials and refers to the process where the system components achieve a state that does not flow (or supports shear stress) without being highly ordered or crystalline. One of the major goals of this study was to explore how varying one dimension in our quasi-2d geometries (i.e. modifying the groove width) affects the various characteristics of jamming observed in previous research of this group as well as in the literature. The study attempted to answer questions of how the new constraint affects the relaxation times of the system, the packing fraction at which the system jams, the behavior of the pair-correlation function and the distribution of the number of neighbors of spheres of each size. It is important to continue studying jamming and confinement of colloidal systems not only because of their significance in condensed matter theory, but also because of their potential use in solving practical problems and maximizing advancements in technology. The system chosen for this research was a suspension of 3.56 μm and 2.56 μm diameter silica spheres (with a ratio of 1:1 by number) in water, placed in silicon elastomer grooves of 25 μm, 20 μm and 14 μm widths and a fixed depth of 5μm. The particles were observed using optical microscopy and the motions of individual spheres were tracked from frame to frame for over 1000 frames. Based on some preliminary data, there appears to be an increase of order in the system due to confinement and an earlier onset on jamming in narrower grooves.