2017

Fabricating non-close packed colloidal monolayers for ion irradiation templates

Nandini Padaraju
Cleveland State University

Fabricating Non-close Packed Colloidal Monolayers for Ion Irradiation Templates

College of Sciences and Health Professions and
Washkewicz College of Engineering

Student Researcher: Nandini Padaraju

Faculty Advisors: Christopher L. Wirth and Jessica E. Bickel

Abstract

Due to their unique properties, anisotropic nanoparticles are desirable components for future applications yet there are few processes capable of fabricating nanoparticle impregnated coatings for the manufacturing environment. Our work seeks to develop new masking techniques for the production of the templated substrates that will induce ordered nanoparticle films. Specifically, we are fabricating non-close packed colloidal monolayers onto silicon substrates, which then serve as the template for ion irradiation. The first steps to creating this monolayer are obtaining a spin-coated poly(vinyl alcohol) (PVA) thin film of ~200 nm and a close-packed colloidal monolayer using a peltier heater. We achieved a thin film of PVA with the desired thickness by examining the effects of the RPM and viscosity, measured by a rheometer, on film thickness which was evaluated with atomic force microscopy. Results showed that as the RPM increases and the viscosity decreases, the thickness decreases. To form the colloidal monolayer, a drop of silica spheres suspended in ethanol was placed on a silicon wafer and mounted onto a peltier element inside a closed box with fixed tilt, temperature, and humidity. We show that we can reduce the number of defects in the monolayer by cleaning with a piranha etch.