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Scalable Assembly of Nanoparticles onto Templated Substrates

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MSL ACADEMIC ENDEAVORS

Scalable Assembly of Nanoparticles onto Templated Substrates

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Abstract

Anisotropic nanoparticles, such as carbon nanotubes and noble metal nanorods, have excellent electrical, mechanical, and thermal properties. This work examined techniques for the nanopatterning of silicon substrates for the subsequent deposition of anisotropic nanoparticles in order to exploit their properties in macroscopic applications. Argon-ion-sputter induced rippling of Si (100) as well as a microparticle mask were examined as methods for templating a silicon substrate. For the ion-sputter technique, the angle of incidence of the ion beam was 67° from the surface normal, with beam energies between 1 and 5 keV, and ion beam fluxes between 1700 and 5000 □A/cm^2. Rippled structures were not observed under these conditions. As an alternative, we used a single layer of microspheres which had been arranged into a close-packed structure as a template. This surface will then be irradiated at normal incidence with argon ions. By doing so, a network of channels is expected to be formed in-between the microspheres. Future work will examine the influence of beam flux on the formation of rippled structures, as well as exploring the effect of variations in particle size and concentration on the formation of large monolayer template areas.