Abstract Submitted
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Effect of Surface Roughness on Nanoparticle Adhesion[1] ZHEN CAO, ANDREY DOBRYNIN, University of Connecticut, JAN-MICHAEL CARRILLO, Oak Ridge National Laboratory, ANDREW OYER, Naval Research Laboratory, MARK STEVENS, Sandia National Laboratories — We study effect of surface roughness on adhesion of soft nanoparticles. Using molecular dynamics simulations we obtained deformation of nanoparticles and their effective contact area with substrates as a function of nanoparticle crosslinking density, surface energy, work of adhesion, and surface roughness. We modeled adhesion of nanoparticles on substrates with periodic patterns (1-D stripes and 2-D square lattice of posts) and with random height distribution. Our simulations show that the JKR-like model can be applied to describe adhesion of strongly crosslinked large nanoparticles, while for the weakly crosslinked nanoparticles, that undergo large deformations, the change of surface energy should be included to account for nanoparticle shape deformation. We propose a simple scaling model which shows that equilibrium shape of nanoparticle is a result of fine interplay between nanoparticle surface energy, elastic energy and work of adhesion to the substrate. The predictions of the scaling model are in a very good agreement with simulation results.

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