Abstract Submitted
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Elastocapillarity: Adhesion and Wetting in Soft Polymeric Systems[1] ZHEN CAO, Univ of Connecticut - Storrs, MARK STEVENS, Sandia National Laboratories, ANDREY DOBRYNIN, Univ of Connecticut - Storrs — We study interactions of nanoparticles with adhesive elastic substrates by using molecular dynamics simulations and theoretical calculations. The deformation of nanoparticles and substrates are obtained as a function of the nanoparticle and substrate shear modulus, nanoparticle size, and strength of interactions. There are two different interaction regimes between nanoparticles and substrates. The classical JKR model can be applied to describe adhesion of strongly cross-linked large nanoparticles on rigid substrates when small nanoparticle deformations and substrate indentations take place. In this adhesion regime the deformation of nanoparticles and substrates is determined by balancing the elastic energy of deformation and the work of adhesion between a nanoparticle and a substrate. However, for the weekly cross-linked (soft) systems, the change of the surface energy of nanoparticle and substrate could play an important role in controlling nanoparticle-substrate interactions. In this so-called wetting regime the interaction between nanoparticle and substrate is determined by the surface tension of substrate or nanoparticle and the work of adhesion. We developed an analytical model describing crossover between adhesion and wetting regimes. In the framework of this model a crossover between different interaction regimes is controlled by a universal dimensionless parameter.

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