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Gluing Soft Interfaces by Nanoparticles[1] ZHEN CAO, ANDREY DOBRYNIN, Univ of Akron — Using a combination of the molecular dynamics simulations and scaling analysis we studied reinforcement of interface between two soft gel-like materials by spherical nanoparticles. Analysis of the simulations shows that the depth of penetration of a nanoparticle into a gel is determined by a balance of the elastic energy of the gel and nanoparticle deformations and the surface energy of nanoparticle/gel interface. In order to evaluate work of adhesion of the reinforced interface, the potential of mean force for separation of two gels was calculated. These simulations showed that the gel separation proceeds through formation of necks connecting nanoparticle with two gels. The shapes of the necks are controlled by a fine interplay between nanoparticle/gel surface energies and elastic energy of the neck deformation. Our simulations showed that by introducing nanoparticles at soft interfaces, the work required for separation of two gels could be 10-100 times larger than the work of adhesion between two gels without nanoparticle reinforcement. These results provide insight in understanding the mechanism of gluing soft gels and biological tissues by nano- and micro-sized particles.

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