

Abstract Submitted
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Chain conformation near the substrate interface in nanoparticle stabilized polymer thin films¹ DEBORAH BARKLEY, MANI SEN, NAISHENG JIANG, MAYA ENDOH, TADANORI KOGA, Stony Brook University, GUANGCUI YUAN, SUSHIL SATIJA, Center for Neutron Research, NIST, YUGANG ZHANG, OLEG GANG, Brookhaven National Lab, ALAMGIR KARIM, University of Akron — When nanoparticles (NPs) are added to polymer thin films, they often migrate to the film-substrate interface and form a “diffused immobile interfacial layer”, which serves to screen the polymer-substrate interaction and suppress dewetting. The fundamental, but unsolved question is how the conformations of the polymer chains in the layer are affected by the NPs and how that impacts the enhancement of film stability. To address the question, we used dodecane thiol-functionalized gold NPs (2.4 nm diameter) and polystyrene (PS, Mw=30kDa). We found that the critical concentration of the Au NPs to induce complete dewetting suppression of 20 nm-thick PS/Au thin films on cleaned Si substrates is 5 wt% (wt of particle/wt of polymer). To investigate the interfacial structures at the polymer-solid interface, we rinsed the annealed PS/Au thin films with toluene and characterized the residual interfacial layers by using various x-ray and neutron scattering techniques. The results indicate that the conformation of the polymer chains closer to the substrate becomes less flattened with the addition of gold NPs, allowing chains at the substrate to entangle more effectively with free chains comprising the bulk film. The detailed mechanism will be discussed.

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