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Tailoring Surface Roughness by Grafting Nanoparticles to Random Copolymer Films[1] MATTHEW CAPORIZZO, RAMI EZZIBDEH, RUSSELL COMPOSTO, The University of Pennsylvania — The effect of random copolymer composition on surface attachment and sinking of amine functionalized silica nanoparticles (d=45 nm) is investigated. Films of poly(styrene-ran-tert-butyl acrylate) (StBA) with 37% tBA are converted to poly(S-ran-acrylic acid) (SAA) by annealing for 15h at temperatures ranging from 135C to 200C. The conversion of the tBA ranges from under 10% to 100% and is monitored by ellipsometry and ATR-FTIR. At complete conversion (25 wt% AA), SAA forms nano-phase separated domains that result in particle aggregation within AA rich domains. At lower AA conversion, a disordered polymer morphology leads to grafting sites which are randomly distributed. NPs graft from nearly a complete monolayer to multilayers depending the percent of AA. Both the rate of NP attachment and the maximum loading of NPs into the film scale with the fraction of AA; this behavior is attributed to a reduction in the energetic barrier for the particle to sink into the film with increased swelling (more hydrophilic). A particularly attractive outcome of this systematic study is that optically transparent films with controlled roughness can be routinely prepared. Such films are of interest for investigating biomolecular adsorption and superhydrophobic, clear, non-fouling coatings.

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