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Tailored Nanoparticles for Enhancing Polymer Adhesion GREGORY SU, KATHERINE BEST, THANGAMANI RANGANATHAN, TODD EMRICK, ALFRED CROSBY — Nanoparticles have been widely reported to affect the physical properties of bulk polymer materials. Here, we report the ability of tailored inorganic nanoparticles to enhance interfacial properties, specifically the self-adhesion of a polymer melt. Gold nanoparticles tailored with low-molecular weight (MW$\sim$1500 g/mol) polystyrene ligands are introduced to the surface of a polystyrene film (MW$\sim$278 kg/mol) with low polydispersity. A second polystyrene film is brought into contact with the nanoparticle-decorated surface and subsequently annealed. The resulting interfaces were characterized with the double cantilever beam (DCB) method to determine the strain energy release rate, G_c, of the welded interface as a function of nanoparticle surface coverage. The interfacial strength (G_c) increases with nanoparticle area fraction until a maximum G_c is achieved at an optimal value of 0.07%. The value of G_c approximately increased by 100% relative to a sample without nanoparticles. This enhancement of interfacial adhesion reveals the potential for utilizing nanoparticles to improve mechanical properties of polymer interfaces in general.

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