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Controlling Au Nanorod Dispersion in Thin Film Polymer Blends¹ MICHAEL J.A. HORE, RUSSELL J. COMPOSTO, Dept. of Materials Science and Engineering, University of Pennsylvania — Dispersion of Au nanorods (Au NRs) in polymer thin films is studied using a combination of experimental and theoretical techniques. Here, we incorporate small volume fractions of polystyrene-functionalized Au NRs ($\phi_{rod} \approx 0.05$) into polystyrene (PS) thin films. By controlling the ratio of the brush length (N) to that of the matrix polymers (P), we can selectively obtain dispersed or aggregated Au NR structures in the PS-Au(N):PS(P) films. A dispersion map of these structures allows one to choose N and P to obtain either uniformly dispersed Au NRs or aggregates of closely packed, side-by-side aligned Au NRs. Furthermore, by blending poly(2,6-dimethyl-p-phenylene oxide) (PPO) into the PS films, we demonstrate that the Au nanorod morphology can be further tuned by reducing depletion-attraction forces and promoting miscibility of the Au NRs. These predictable structures ultimately give rise to tunable optical absorption in the films resulting from surface plasmon resonance coupling between the Au NRs. Finally, self-consistent field theoretic (SCFT) calculations for both the PS-Au(N):PS(P) and PS-Au(N):PS(P):PPO systems provide insight into the PS brush structure, and allow us to interpret morphology and optical property results in terms of wet and dry PS brush states.

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Michael J. A. Hore
Dept. of Materials Science and Engineering, University of Pennsylvania

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