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Theoretical and Experimental Studies of New Polymer-Metal High-Dielectric Constant Nanocomposites VALERIY GINZBURG, MICHAEL ELWELL, KYLE MYERS, ROBERT CIESLINSKI, SARAH MALOWINSKI[1], MARK BERNIUS, The Dow Chemical Company — High-dielectric-constant (high-K) gate materials are important for the needs of electronics industry. Most polymers have dielectric constant in the range $2 < K < 5$; thus to create materials with $K > 10$ it is necessary to combine polymers with ceramic or metal nanoparticles. Several formulations based on functionalized Au-nanoparticles ($R \sim 5$ - 10 nm) and PMMA matrix polymer are prepared. Nanocomposite films are subsequently cast from solution. We study the morphology of those nanocomposites using theoretical (Self-Consistent Mean-Field Theory [SCMFT]) and experimental (Transmission Electron Microscopy [TEM]) techniques. Good qualitative agreement between theory and experiment is found. The study validates the utility of SCMFT as screening tool for the preparation of stable (or at least metastable) polymer/nanoparticle mixtures.

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