Combination of nanoscale inorganic particles and polymers offers various physical properties that arise from the synergies between the components. However, dispersion of particles in polymer matrices frequently results segregation/aggregation of particles that negates almost all desired macroscopic properties. In this presentation, the level of aggregation of oxidic particles in different types of polymeric systems is discussed. The first part of the talk presents dispersion of ZnO nanoparticles in different architecture of in-situ-polymerized poly(methyl methacrylate) (PMMA). The particles inevitably undergo segregation or aggregation upon polymerization of linear PMMA because of depletion attraction. However, this attraction is suppressed when a difunctional monomer, for example ethylene dimethacrylate, is used as comonomer. The formation of branching and crosslinking points prevents depletion mechanism and enhances the quality of the particle dispersion in the polymeric matrix. We believe that this novel route can be a general strategy to obtain more homogeneous dispersions in vinyl polymers. The second part describes a statistical model demonstrating the aggregation of fumed SiO$_2$ nanoparticles in amorphous polydimethylsiloxane matrix. This model is based on a counting technique originally used in genome analysis to characterize the size and distribution of overlapping segments randomly place on DNA. It is demonstrated that the predictions of this model agree with experimental results.