A New Highly Efficient Route to Polymer-Silica Colloidal Nanocomposite Particles

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New colloidal vinyl polymer-silica nanocomposite particles are synthesized via aqueous emulsion polymerization of either styrene or a 1:1 styrene/*n*-butyl acrylate mixture at 60^{o}C using a cationic azo initiator in the presence of a surface-functionalized ultrafine aqueous silica sol as the sole stabilizing agent.[1-3] This new protocol is surfactant-free and requires neither auxiliary comonomer nor any non-aqueous co-solvent. Optimization of the silica sol concentration leads to remarkably high silica aggregation efficiencies for both polystyrene/silica and poly(styrene-stat-*n*-butyl acrylate)/silica nanocomposite syntheses. The latter formulation allows highly transparent films (containing up to 38 wt. % silica) to be cast at ambient temperature. X-ray photoelectron spectroscopy, aqueous electrophoresis and energy-filtered TEM studies both suggest well-defined core-shell (latex core, silica shell) morphologies. This interpretation agrees well with our unpublished small-angle x-ray scattering results, which confirms that the silica shell is confined to a monolayer. In principle, such formulations offer considerable potential for tough, transparent nanocomposite coatings.

References:

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[3] A. Schmid et al., Macromolecules, **2009**, *42*, 3721.