Poster 3

Preparation of SiO_2/PBuA-co-PMMA Nanocomposite Latexes via Miniemulsion Polymerization for Coating and Adhesive Applications

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Various methods for the preparation of organic/inorganic nanocomposite particles in aqueous suspension have been reported in the literature. The most frequently described method is based on the surface modification of inorganic particles, followed by emulsion polymerization. Recently, researchers have turned their attention to miniemulsion polymerization as it is believed that it is a promising technique to prepare a latex in which almost all the inorganic particles are encapsulated with polymer.

In this study silica/polymethylmethacrylate-co-polybutylacrylate (SiO_2/PMMA-co-PBuA) nanoparticles were prepared by the miniemulsion polymerization technique. Two different silicas with particle diameters of 20 and 80 nm were first modified by γ-methacryloxypropyl trimethoxysilane in order to compatibilize them with the organic monomers. They were then dispersed in MMA/ BuA mixtures of varying compositions, with and without acrylic acid (AA). The weight percent of the functionalized silica varied from 2% to 20% with respect to the monomers. Finally, the organic suspensions of silica were introduced into deionized water containing surfactant, miniemulsified by sonication and polymerized. The effects of the silica particle size and concentration on the droplet size were investigated for different compositions and concentrations of the monomer mixtures.

Reaction kinetics were studied by following the evolution of the particle size, particle size distribution and the ratio of the number of the composite particles to the number of droplets during the reaction.

The results show that after organic modification, the silica particles can be easily dispersed in MMA or a mixture of MMA and BuA as long as the percentage of BuA is kept below 50 wt%. The droplet size increases as the amount of silica increases with respect to the monomer. The same trend was observed when the solid content was increased from 28% to 50%. With increasing the BuA:MMA ratio, relatively larger droplets and consequently larger particles were obtained in the presence of silica. In every cases, TEM observations showed spherical polymer particles containing randomly distributed silica beads.

Keywords: silica, nanocomposite, miniemulsion, droplet size, particle size, coating, adhesive