

Packing Efficiency of Small Silica Particles on Large Latex Particles

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The adsorption of small silica particles onto large sterically-stabilized poly(2-vinylpyridine) [P2VP] latex particles in aqueous solution is assessed as a potential route to core-shell nanocomposite particles.¹ Geometric considerations allow the packing efficiency, P , to be related to the number of silica particles per latex particle, N . Dynamic light scattering is used to obtain a plot of hydrodynamic diameter against N , which indicates the conditions required for monolayer coverage of the latex by the silica particles. On this basis, an experimental value for P of approximately 69% was estimated for core-shell nanocomposite particles prepared by the heteroflocculation of a 20 nm silica sol with near-monodisperse P2VP latexes of 463 nm and 616 nm diameter at approximately pH 10. Transmission electron microscopy confirmed that, at approximately monolayer coverage, calcination of these nanocomposite particles led to the formation of well-defined hollow silica shells. This is interpreted as strong evidence for a contiguous monolayer of silica particles surrounding the latex cores. Field emission scanning electron microscopy and x-ray photoelectron spectroscopy were also used to assess the extent of latex surface coverage by the silica particles. The latter technique gave good agreement with silica packing efficiencies estimated from calcination studies.

References:

[1] J. Balmer *et al.*; *Langmuir*, **2009**, 25, 5339.