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Light-induced reversible destabilization of responsive latex particles prepared via high solids content emulsion polymerization

Abstract

Aqueous dispersions of polymer nanoparticles (latexes) are of high commercial importance — it can be desirable to reversibly destabilize such latexes, for example, to enable transport/storage without the significant weight fraction of the water. In the present work, we have employed ab initio emulsion polymerization of methyl methacrylate with industrially relevant high solids content using mixtures of the anionic surfactant sodium dodecyl sulfate (SDS) and the photo-switchable cationic surfactant 2-(4-(4-butylphenyl)diazenylphenoxy)ethyltrimethylammonium bromide (C4AzoTAB). C4AzoTAB contains an azobenzene moiety that can undergo trans–cis isomerization triggered by UV light, the cis form being a less effective surfactant than the trans form. Rapid destabilization (sedimentation) could be achieved on exposure of the diluted latex to UV light using a continuous flow device, and subsequent redispersion was obtained on exposure to visible light, demonstrating reversibility of the process. The presence of the anionic SDS as well as judicious choice of the amphoteric initiator VA-057 play key roles in designing successful destabilization, with latex pH being of crucial importance.

Keywords

Emulsion; Photo-switchable surfactant; Polymer nanoparticle; Reversible destabilization