Functionalization of nanoparticles by surface-initiated RAFT polymerization: Chemistry and applications

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Reversible addition-fragmentation chain transfer (RAFT) polymerization has been applied to the controlled polymerization of various monomers under a broad range of conditions to prepare polymer materials with predetermined molecular weights, narrow polydispersities, and advanced architectures. The combination of the RAFT technique with polymer grafting techniques has been widely used as an approach to modify the surfaces of nanoparticles with a variety of functional polymers. In our work, we developed multiple approaches for attaching RAFT agents to the surface of nanoparticles with graft densities ranging from 0.01 to 0.8 chains/nm^2. Using these surface-immobilized RAFT agents, styrenic, acrylate, and methacrylate monomers could be polymerized on the nanoparticle surfaces via surface-initiated RAFT polymerization in a controlled manner. The availability of the wide range of graft densities has allowed us to study the polymer chain behavior in both the brush and mushroom regions. This presentation will provide a general overview of the chemistry used to prepare polymer-grafted nanoparticles with precise control over the polymer chain variables, and a few select applications of grafted nanoparticles.

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