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New functions of maleic anhydride grafted polypropylene for manipulation of magnetic nanoparticle assembly patterns

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Magnetic nanoparticles has severe dispersion problem in solution due to the high surface energy and large specific surface area, and, strong intrinsic dipolar-dipolar interactions and van der Waals forces. The commonly used approach to synthesize stabilized magnetic nanoparticles is to introduce surfactants including fatty acid surfactants such as oleic acid, lauric acid, and amines like oleylamine and trioctylamine to overcome the agglomeration. However, the surfactant removal procedure is usually costly and time-consuming, which makes these small surfactants incompatible for synthesizing stabilized magnetic polymer nanocomposites.

In spite of many specialized functional polymers and block copolymers with strong intrinsic affinity to bind magnetic nanoparticles and have been extensively utilized to serve as stabilizers for magnetic nanoparticles, the usage of hydrocarbon polymers such as polyolefin-based plastics as the stabilizer for magnetic nanoparticles are still challenging due to the lack of reactive site for stabilizing magnetic nanoparticles and weak interfacial interactions. Therefore, how to find a bridging material to disperse magnetic nanoparticles is the key issue to successfully fabricate magnetic nanoparticles using polyolefin products.

Here we demonstrate the successful utilization of an old fashioned plastic additive- maleic anhydride grafted polypropylene (PP-g-MA) to synthesize stabilized magnetic nanoparticles with the well controlled assembly patterns such as mono-dispersion vs. highly ordered chain-like structure assembly. In addition, the unique discovery is that the crystalline phase of the target nanoparticles can be also manipulated upon changing the reaction composition.

Biography

Qingliang He is currently a Ph.D. candidate majored in Chemical Engineering at Lamar University. His research focuses on the design, synthesis, and application of novel magnetic nanomaterials including nanoparticles and nanocomposites. He has published ~ 30 papers in top notched journals and has been serving as reviewers for several high ranking peer-reviewed journals.

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