Processing of Polymer-based Nanocomposites: Processing-Structure-Property-Performance Relationships: 75-106

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Rubber nanocomposites: Processing, structure–property relationships, applications, challenges, and future trends

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ABSTRACT:

This chapter discusses the roles of different nanoparticle types such as clays, CNTs, and graphene-based materials in the rubber manufacturing processes. It is shown that nanoparticles not only reinforce rubber matrices, but they can also accelerate cross-linking reactions during vulcanization/curing and save energy. Further, the degree of reinforcement depends strongly on the dispersion of the nanoparticles within the nanocomposites. Accordingly, different rubber fabrication technologies can give rise to different dispersion states, and, hence, different final properties. Often, nanocomposites prepared via solutionmixing or in situ polymerization exhibit better dispersion than those prepared via the melt-intercalation method. However, the environmental and cost issues associated with the solvents used in these methods limit their widespread and large-scale use. Finally, this chapter shows that the morphology of the nanoparticles (i.e., segregated structures) within the matrix can enhance properties such as electrical conductivity and permeability more effectively than dispersion itself (i.e., non-segregated structures).