Tailoring of novel rubber nanocomposites for advanced applications

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Polymer nanocomposites are recognized as one of the most promising research areas in polymer science and technology in the 21st century. Most of the polymer-clay nanocomposites display best physico-mechanical properties at a significantly low loading of nanoclay unlike conventional filler, where higher loading not only increases weight but also affect some of the properties of pristine polymer. However, reports on solely rubber/clay system are not very extensive. Also, the structure-property relationship in the rubber-clay nanocomposites is yet to be understood. Even though the development of rubber/organoclay nanocomposites is still in its infancy, recent work in the nanocomposites area suggests that the current focus is on rubbers of both thermoplastic and thermoset nature and also thermoplastic/rubber blends. The interest in rubber nanocomposites is mainly due to the reinforcement anisotropy and barrier properties that can be achieved by exfoliated silicate layers having nanoscale thickness. Further, novel organophilic silicates are envisaged to be developed that would be specifically ‘‘tailored’’ for elastomers. Overall, a lot of scope exists to create novel rubber products using nanoclay as the reinforcing material in rubber matrices. In the present work we aim to show that understanding the influence of surface characteristics is the basis for selecting the ideal oraganoclay for the given rubber matrix. The organoclays used in the present study were selected to explore the effects of the amine surfactant structure on the dispersion of clay particles in different rubber matrices. Understanding the interaction between organically modified clay platelets and organic solvent molecules as well as the corresponding structure of organoclays in a suspension is a critical step toward tailoring and characterizing rubber nanocomposites. Moreover, the use of other nano fillers like titanium dioxide, calcium phosphate etc. to obtain multifunctional materials with enhanced