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PREPARATION AND CHARACTERIZATION OF POLYBUTADIENE RUBBER/ORGANOCLAY AND STUDY OF THEIR RHEOLOGICAL AND MECHANICAL PROPERTIES

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Since polybutadiene rubber (BR) is a hydrophobic polymer, choosing the right method to prepare its nanocomposites with layerd silicates without a Compatiblizer seems critical. In this study, BR/organoclay nanocomposites were melt mixed in a laboratory internal mixer and the effect of processing conditions such as temperature, rotor speed and time, as the main variables, on dispersion state of layered silicates in the polymer matrix were investigated using X-ray diffraction (XRD) and mechanical properties. Then nanocomposite samples with different organoclays (Cloisite 15A, 25A, 10A and Nanofil SE3000) were prepared using the optimum conditions. Investigation on vulcanization behavior of the samples revealed that the organoclays with higher hydrophobicity showed lower scorch and cure time and larger torque difference. Viscoelastic response of the samples was thoroughly investigated using dynamic rheological analysis to study the effect of different organo-modifiers on dispersion state of layered silicates. Although polybutadiene is a highly elastic polymer, the effect of variation in organo-modifier type on rheological properties was evident. It was also found that the nanocomposite containing Nanofil shows the highest elasticity implying a better dispersion state of layered silicates as compared to the other organoclays. This behavior could be attributed to the longer aliphatic chains residing on the surface of Nanofil layers which facilitate the penetration of BR chains into the organoclay lavers. Moreover, since BR is a high-molecular-weight material, its high viscosity induces higher levels of shear stress during the melt-mixing process leading to more disruption of clay structure which is more pronounced in the case of Nanofil in comparison with the other organoclays. XRD results were used to further corroborate the abovementioned results. Mechanical properties of the samples were also investigated in terms of different organoclays.