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NR/SBR/ORGANOCLAY NANOCOMPOSITES: THE ROLE OF THE MOONEY VISCOSITY AND MELT ELASTICITY IN MELT INTERCALATION OF RUBBER PHASES

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Nanocomposites based on (70/30) blends of natural rubber (NR), styrene-butadiene rubber (SBR) and organo modified clay (OC) have been prepared via melt mixing process. Effects of interfacial compatibilizer, mooney viscosity and melt elasticity of rubber phases upon the extent of melt intercalation, and hence nanocomposites microstructure has been investigated. The microstructure of the nanocomposites was characterized by means of XRD, TEM, and melt viscoelastic characterization. The obtained results showed much higher extent of intercalation and enhancement in melt elasticity for NR/OC nanocomposite than SBR/OC counterpart. This was found to be attributed mainly to the less melt elasticity of used NR than SBR. Also, dynamic mechanical thermal analysis showed higher shift of the NR glass transition temperature and lower damping factor (tanδ) in the NR/OC nanocomposite, indicating more polymer –filler interacting sites in NR than SBR. From thermodynamic point of views, in a relatively non polar rubber blends such as NR/SBR, the organoclay is expected to be located in both NR and SBR phases. These were confirmed by the presence of nanolayers silicate in both phases as revealed by TEM, suggesting that organoclay has not selectively located in NR or SBR. However, Melt elasticity of the two rubber phases showed to be the main controlling parameter in intercalation process, whereas mooney viscosity found to be less effective, indicating that resistance of the rubber segments towards entropy loss as a result of confinement in clay galleries is the key control in the formation of the blend microstructure. Incorporation of maleic anhydride grafted ethylene propylene rubber (EPDM-g-MAH) and epoxidized natural rubber (ENR50) as compatibilizer onto the blend system increased the extent of intercalation and dispersion of organoclay in both phases, leading to more dynamic hysteresis and higher fatigue life. Also, the presence of compatibilizer system increased tensile properties of the blend nanocomposites.