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Study on Microstructure and Rheological Properties of Cellulose Short Fiber Reinforced TPVs Based on EPDM/PP

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The morphology, rheology and mechanical properties of the dynamically vulcanized thermoplastic elastomer based on EPDM/PP (60/40 w:w) containing 5, 10 and 20% of cellulose short fiber were studied. The samples were prepared in a laboratory internal mixer at rotor speed of 60 rpm. The melt linear viscoelastic properties of the samples were investigated by using Rheometric Mechanical Spectrum. From the results it was found that addition of 5% of cellulose fiber has no significant effect on the maximum torque associated with the dynamic vulcanization stage, while higher concentration of fibers decreased the maximum torque. These results were explained in terms of influence of cellulose fibers on the extent of agglomeration formed between the cured rubber particles. The results of tensile test performed on the samples showed that incorporation of 5% of cellulose fibers in to the sample has an increasing effect on elongation at break with no appreciable change in tensile behavior. However increasing the cellulose fibers content of the sample to 20% had a remarkable change in tensile properties of the sample resulting in a toughened plastic type behavior. These results were attributed to the interaction of the fibers with the PP chains in amorphous region in particular, those chains which are trapped between the cured rubber aggregates. Hardly any deep holes resulting from pulling out of fibers observed in the SEM micrographs suggested strong interfacial adhesion between the cellulose fibers and PP matrix as a result of dynamic vulcanization of the rubber phase adhered on the fiber surface. The dynamic viscosity and storage modulus of the sample containing 20% of cellulose fibers was found to be lower than those of samples containing 10% indicating that for this sample the fibers form a separate phase with minimum interaction with the agglomerate formed between the cured rubber particles. This was supported with the result of the relaxation time distribution $H(\lambda)$ of this sample.