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MORPHOLOGY DEVELOPMENT IN NOVEL COMPOSITION OF THERMOPLASTIC VULCANIZED (TPV) BASED ON PA12/PDMS REACTIVE BLENDS

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The main objective of the present work was to tailor a new TPV composed of Polyamide 12 (PA12) as the thermoplastic phase and Polydimethyl-vinylmethyl-siloxane (vinyl-PDMS) as the rubber phase. The PDMS was crosslinked by Dicumyl peroxide (DCP). The advantage of this free radical crosslinking reaction is the possibility to control its extent at the mixing step and at higher temperatures using 2,2,6,6-tetramethylpiperidinyloxy (TEMPO) as an inhibitor. Interestingly, addition of TEMPO to the TPV novel composition provided the PA12/PDMS blend compatibilization in the dynamic process and gives a new material having a controlled structure and morphology. In this study a better understanding of the PA12/PDMS blend compatibilization and the silica nanoparticles dispersion mechanisms were achieved through reactive processing. The electron microscopy (SEM and TEM) studies revealed that adding silica nanoparticles and Lotader in PA12 and PDMS phases respectively, lead to a drastic reduction of Rv of the PDMS particles from 16.5 μm (virgin blend) to nearly 0.6 μm for the PA12/PDMS reactive blend. Furthermore, the SEM and TEM micrographs showed migration of the silica nanoparticles from the PA12 phase to the PA12/PDMS interface. In addition, the interface between PA12 and PDMS has been changed by PA12/Silica/PDMS interphases of a hundred of nanometers thick. Therefore, obtained stable core-shell morphology showed that silica nanoparticles (shell) encapsulate PDMS phase (core) in the PA12 matrix. Interestingly, the resulting modification of interfacial thermodynamics explains the observed confinement. Finally, a stable co-continuous morphology was obtained for the new TPV based on 60-40 wt% of PDMS-PA12 blend.