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PHASE STRUCTURE AND IMPACT-TOUGHENING MECHANISMS IN POLYPROPYLENE/POLYOLEFIN ELASTOMER/NANO CACO3 TERNARY COMPOSITES

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Significant toughening is often obtained in semicrystalline polymers with dispersion of rubber particles [1,2].However, the addition of rubber often induces a substantial loss in elastic modulus. In the present study, we investigate how to avoid such softening by the addition of rigid nano-particles of calcium carbonate and how to obtain a simultaneous enhancement of toughness and modulus of PP. A polypropylene copolymer matrix was toughened simultaneously with nano-size calcium carbonate and polyolefin elastomers (POE) [3]. The nanocomposites were prepared by melt-blending PP, CaCO3, and POE in a twin-screw extruder, followed by injection molding. The tensile and impact properties of such systems are compared to those of binary composites PP/POE and PP/CaCO3. We report that a significant improvement in the impact strength and elastic modulus of the PP matrix is obtained with dispersions of 1-5 wt % fillers. The phase structuration of ternary composites is investigated using Scanning Electronic Microscopy, Dynamic Mechanical Analysis, and Differential Scanning Calorimetry. The behavior of nanocomposites is strongly influenced by the dispersion of the fillers and the interfacial interaction between the different components. References [1] J. Yang, Y. Zhang, Y. Zhang, Brittle-ductile transition of PP/POE blends in both impact and high speed tensile tests, Polymer. 44 (2003) 5047-5052. [2] E.B. Rabinovitch, J.W. Summers, G. Smith, Impact modification of polypropylene, J Vinyl Addit Technol. 9 (2003) 90-95 [3]C. Ma, Y. Mai, M. Rong, W. Ruan, M. Zhang, Phase structure and mechanical properties of ternary polypropylene/elastomer/nano-CaCO3 composites, Composites Science and Technology. 67 (2007) 2997-3005