Melt compounding of ZrP lamellar nanocomposites using aqueous slurry

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This work focuses on the processing of materials obtained from a synthetic lamellar filler, α-zirconium phosphate (α-ZrP), dispersed within a synthetic rubber of the SBR type. Blending of aqueous slurry of filler within a molten polymer avoids the handling of powder of nanoparticles[1]. However, this requires to overcome three major issues: at first, strong physical and chemical incompatibility (hydrophilic vs hydrophobic), secondly the high viscosity ratio between the slurry and the polymer matrix (low viscosity vs very high viscosity) and at third, elimination of the aqueous phase[1]. Processing of the filler intercalated with alkylammonium surfactants[2] using a batch mixer and a twin-screw micro-extruder were tested[3]. X-ray diffraction and transmission electron microscopy were used to quantify the state of dispersion of the filler within the nanocomposite. Melt or solid dynamic rheological analysis were used to connect different classes of morphologies observed and the viscoelastic behavior of nanocomposites. References: [1] N. Hasegawa and al., Polymer 44, 2003, 2933-2937 Z-Z. Yu and al., J. Polymer Science: Part B: Polymer Physics, 43, 2005, 1100-1112 N. Fedullo and al., Macromol. Symp., 233, 2006, 235-245 [2] T.D. Fornes and al., Polymer 42, 2001, 9929-9940 T.D. Fornes and al., Polymer 43, 2002, 5915-5933 W. J. BOO and al., J. Polymer Science: Part B: Polymer Physics, 45, 2007, 1459–1469 [3] H. R. Dennis and al., Polymer 42, 2001, 9513-9522 F. Schön and al., Macromol. Symp. 2002, 189, 105-110 J.-T. Kim and al., Polymer International, 2003, 52, 1058-1063 L. S. Brandão and al., J. applied polymer science, 2006, 102, 3868-3876. Key words: nanocomposite, α-ZrP, SBR, lamellar filler, slurry, processing