PLA-based organic-inorganic hybrid materials

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The objective of the present study is to prepare poly(L-lactide) based organic-inorganic hybrid materials. For that propose two strategies have been developed: 1- In situ bulk polymerization of L-Lactide in the presence of 5%wt. of modified fumed silica. The polymerization kinetics was followed from the changes of the complex shear modulus versus reaction time. Adding fumed silica particles into the monomer leads to the formation of a physical (percolated) network from particle-particle interactions, i.e. silica, in the L-Lactide probably hydrophilic interactions. It was found that basic hydrophilic silica leaded to a microcomposite with highly dense agglomerates in the polymer matrix whereas with aless hydrophilic silica it was possible to decrease the size of the agglomerates increasing the dispersion. The best dispersion state was obtained with the “initiating” functionalized silica leading to a “grafting from” polymerization of the L-Lactide. 2-In situ synthesis (sol-gel method) of silica particles in PLA. The generation of PLA-based O/I hybrids has been study from the in situ synthesis of silica particle in molten PLA. The water physically absorbed into the PLA at saturation combined with the linear polydiethoxysiloxe precondensate was used to synthesis the inorganic rich phase through typical hydrolysis-condensation reaction. The presence of a majority of Q3 species showed by solid state 29Si NMR assures that condensation occurred. Interfacial agents, i.e. 3-trimethoxysilylpropylmethacrylate and γ-Aminopropyltriethoxysilane, at different ratios were used to bring physical and/or chemical interactions between the inorganic rich phase and the PLA matrix. TEM images show that even if 3-trimethoxysilylpropylmethacrylate concentrates at the interface, the size of the inorganic rich phase is not lowered and has a diameter o