250a Ecobionanocomposites: a New Class of Green Materials

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Ecological concerns are a predominant theme for the 21st century; humanity must develop sustainable systems for materials and fuels. Biologically derived and inspired materials offer hope for achieving this important goal. Also, nanotechnology is rapidly expanding and its convergence with both biology and ecology is now being recognized. Ecobionanocomposites are a new class of materials that exploit this triple convergence of technologies.

Polylactide (PLA) nanocomposites are representative of these new green materials. PLA is derived from renewable resources utilizing biotechnology techniques. It is an ecologically attractive alternative to increasingly expensive petroleum based plastic materials. Similarly, cellulose is a natural biological polymer with a host of important properties including structural hierarchy at the nanoscale. These crystalline structures with dimensions of nanometers can be isolated by acid hydrolysis of various cellulose sources. The incorporation of such cellulosic nanowhiskers into a polymeric matrix to form a nanocomposite is a known route towards property improvement. A novel approach towards nanocomposites using hydroxyl groups on the surface of cellulose fibers to initiate the polymerization reaction of lactide is reported. Many of the limitations of a two phase composite were overcome by using this reactive compatibilization - ring opening polymerization and transesterification reactions are manipulated. It is demonstrated that the use of reactive compatibilization offers unique opportunities in creating new and value added ecobionanocomposites.