Seminar: Dr. Daniel Hermida Merino

Applied Physics Department, Vigo (Universidade de Vigo)

Wednesday November 19th, 2025 at 13h30
LMOPS, CentraleSupélec, 2 rue E. Belin, METZ
Meeting room (C102)

Nanostructure of customized HMw stereocomplex-PLA copolymers and blends

Polylactic acid (PLA) is a widely employed biobased polymer in diverse fields such as food handling or biomedical applications, usually synthesized by Ring-Opening Polymerization (ROP). However, the current PLA applicability regarding thermal resistance, mechanical properties, and crystallinity kinetics is slightly inferior to conventional petroleum-based polymers. Different strategies have been evaluated to improve the physicochemical properties such as the use of nucleating agents to increase the crystallization rate or the equimolar blend of PLLA and PDLA enantiomers to generate Stereocomplex (SC) crystallites, which features a melting point 50 °C higher than its homocrystals (HC) counterparts. However, the SC crystallization of the blended enantiomers diminishes for high molecular weight (HMw) PLA, and enantiomeric HC are obtained instead [2]. Herein, a novel series of the long-desired HMw stereo-diblock-copolymers of PLA were successfully synthesized by ROP using a heteroscorpionate catalyst without the need for a co-initiator, achieving a full stereocomplex crystallization. Moreover, the crystallization kinetics and morphology, of the designed SC-PLA-derivatives were enhanced to the highest known crystallization rate by the addition of a bioorganic nucleating agent (OXA2) to retain the bio-nature of the composite, which offers promising processing conditions to be scaled at industrial level. Furthermore, the customization of the tacticity and molecular weight through the well-controlled synthesis process, enables the generation of a series of PLA-derivatives exhibiting a wide range of thermodynamic and structural properties, as evidenced by a multitechnique analysis approach (DSC, SAXS/WAXS, Raman), which could potentially promote the personalization of medical applications through the structure-properties relationship and its final applications.

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