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Effect of Molecular Weights on the Physical Properties and Microstructure of Poly(lactic acid)

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A three-phase microstructure involving crystalline, rigid and mobile amorphous regions has been successfully used to describe the macromolecular arrangements in poly(lactic acid) (PLA). The establishment of a rigid amorphous fraction, in particular, is dependent on the molecular motions of polymer chains during crystallization; Our aim is to understand the contribution of the size of the polymer chains (related to their number average molar mass, Mn) on its molecular structure during crystallization. To achieve this, a commercial grade of PLA was hydrolyzed by extrusion in controlled conditions of time, temperature and water content. The glass transition temperatures of these fractions obey the Flory-Fox model and reach a plateau beyond ~20000 g/mol. Preliminary measurements performed by Differential Scanning Calorimeter (DSC) showed that, as Mn decreases and reaches values lower than ~40000 g/mol, cold crystallization starts to occur. As Mn further decreases, the melting peaks associated to cold-crystallized domains gradually shifts towards lower temperatures. PLA crystallizes easier when the polymer chains are shorter, which was confirmed by optical polarizing microscopy. Further characterizations by temperature-modulated DSC were performed to determine whether Mn affects the specific heat capacities at the glass transition and how the rigid amorphous fraction evolves with Mn.

Choix de session parallèle

4.2 Physique des polymères: de la molécule au matériau

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Classification de Session: Séance Parallèle