584e Moisture Sorption and Transport in Polylactide

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Management of moisture penetration and hydrolytic degradation of polylactide (PLA) is extremely important during manufacturing, shipping, storage, and end-use of PLA products. Moisture transport, crystallization, and degradation in PLA have been measured through a variety of experimental techniques including Size-Exclusion Chromatography (SEC), Differential Scanning Calorimetry (DSC), and X-Ray Diffraction (XRD). Quartz Crystal Microbalance (QCM) and Dynamic Vapor Sorption (DVS) experiments have also been used to measure moisture sorption isotherms in PLA films with varying crystallinity. A surprising result is that crystalline and amorphous PLA films exhibit identical sorption isotherms, within the accuracy of the experimental data. A hypothesis to explain this result is that water sorption in PLA is controlled by hydrophilic acid and alcohol end groups. Modifying the end groups in PLA to make them more hydrophobic has been attempted to improve the moisture barrier properties of PLA.