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Spectroscopic Analysis of Unusual Poly (lactic acid) Structures.
KAORU AOU, GUOLIN WU, SHUHUI KANG, SHAW LING HSU, Polymer Sci. and Engn., Univ. of Massachusetts Amherst — Poly (lactic acid) (PLA) is a biomass-derived polymer with a broad range of applications. We previously unambiguously determined the chain conformation of PLA to be a 10/3 helix based on a combination of experimental and normal coordinate analyses, in the process assigning band splittings to the intrahelical interactions. Here, we investigate the nature of intermolecular interactions within the PLA crystals as well as their molecular orientation. In PLA, specific intermolecular interactions such as dipolar coupling strongly influence the spectral features. Crystal field splitting bands in the PLA crystal vibrational spectra were identified. They indicated the strength and proximity of interacting carbonyls and C-H groups and are thus relevant to PLA crystal packing. Results of the studies were used to understand the origins of unusual thermal stability of the PLA stereocomplex with a melting point higher than the α -crystal by at least 50 °C. The knowledge was also applied to characterization of orientation development in PLA tubes during different stages of sequential biaxial deformation.

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