

## Surface Orientation in Polylactic Acid Films by NEXAFS

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Molecular orientation at surfaces can influence several properties of polymers such as wear, tear, and adhesion. The orientation specifically at the surface can be studied by methods such as near edge x-ray absorption spectroscopy (NEXAFS) using a surface sensitive detection scheme such as electron yield and highly polarized illumination. In this work we have used the NSLS beamline U7A endstation which is well suited for these studies with an efficient electron yield detector in addition to other specialized detectors. In this work surface orientation was studied for uniaxial or biaxially stretched polylactaic acid (PLA), a polymer made from natural products (1), films at several orientations relative to the incident x-ray beam.

The results show that there are several changes in the appearance of absorption bands for the uniaxially pulled films. The most significant spectral changes at the surface occur between 1X (not pulled) and 3X (pulled to two times the original length). Here surface orientation (difference between normal and glancing x-ray incidence) decreases and transition A decreases while B increases with greater stretching. This work combined with data from several corroborating methods is being used to better understand the properties of this unique and relatively new polymer.

**References:** 1. D.R. Witzke, "Introduction to Properties, Engineering, and Prospects of Polylactide Polymers," Ph.D. Thesis, Michigan State University, 1997.

