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**Role of Hydrogen Bonding on Nonlinear Mechano-Optical Behavior of *L*-Phenylalanine-based Poly(ester urea)s.**[1] KEKE CHEN, JIAYI YU, The University of Akron, GUSTAVO GUZMAN, S. SHAMS ES-HAGHI, Purdue University, MATTHEW L. BECKER, The University of Akron, MIKO CAKMAK, Purdue University — The uniaxial mechano-optical behavior of a series of amorphous *L*-phenylalanine-based poly(ester urea) (PEU) films was studied in the rubbery state using a custom real-time measurement system. When the materials were subjected to deformation at temperatures near the glass transition temperature ($T_g$), the photoelastic behavior was manifested by a small increase in birefringence with a significant increase in true stress. At temperatures above $T_g$, PEUs with a shorter diol chain length exhibited a liquid-liquid ($T_{ll}$) transition at about 1.06 $T_g$ (K), above which the material transforms from a heterogeneous "liquid of fixed-structure" to a "true liquid" state. The initial photoelastic behavior disappears with increasing temperature, as the initial slope of the stress optical curves becomes temperature independent. Fourier transform infrared spectra of PEUs revealed that the average strength of hydrogen bonding diminishes with increasing temperature. For PEUs with the longest diol chain length, the area associated with N-H stretching region exhibits a linear temperature dependence. The presence of hydrogen bonding enhances the "stiff" segmental correlations between adjacent chains in the PEU structure. As a result, the photoelastic constant decreases with increasing hydrogen bonding strength.

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Keke Chen
The University of Akron

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