



# ΕΡΕΥΝΗΤΙΚΟ ΙΝΣΤΙΤΟΥΤΟ ΧΗΜΙΚΗΣ ΜΗΧΑΝΙΚΗΣ ΚΑΙ ΧΗΜΙΚΩΝ ΔΙΕΡΓΑΣΙΩΝ ΥΨΗΛΗΣ ΘΕΡΜΟΚΡΑΣΙΑΣ

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Static and Dynamic FT-IR Linear Dichroism of Optically Responsive Materials
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### ΠΕΡΙΛΗΨΗ

Side chain liquid crystalline polyurethanes are a new class of materials that show promise for mechanooptic applications. The rich morphology afforded by these materials also provides a chance to understand the interplay between polyurethane morphology and liquid crystalline ordering. In this presentation we will report on our study of the response of a polyurethane with liquid crystals pendant to the soft segments to an applied strain using Fourier Transform Infrared (FT-IR) linear dichroism. We find that this complex material follows trends established in the literature for both side chain liquid crystalline homopolymers and segmented polyurethanes. At low strains, the soft segments align with strain inducing an orientation in “lone” hard segments. Up to strains of 40%, the LC mesogens align with the strain field and the hard segments in hydrogen bonded domains align perpendicular to the field. At strains above 40%, we find a rearrangement of the ordering that results in the smectic layers and the hard segments aligning parallel to the field. A model is proposed to represent these findings, and reflections on the cooperative movement of the different macromolecular components of the polyurethane are offered.

Furthermore, dynamic FT-IR experiments were performed on these materials. These experiments aim in correlating the molecular level responses of these samples to their macroscopic properties. One type of dynamic experiments involves the measurement of the dynamic linear dichroic signal as a function of a sinusoidally modulated strain. It was found that the application of stress induces orientation to both hard and soft segments of the polyurethane system and that the side chain mesogens are free to deform in the elastic soft segment. Finally, the spectral responses at the carbonyl spectral region are indicative of the behavior of the different types of “hard” urethane segments in the polymer.