Application of Infrared Dichroism to the Study of Deformation Behavior of Polyurethanes

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Infrared spectroscopy is a very useful technique to study the orientational behavior of the complicated polyurethane structure. The orientational response of the each segment of the chain can be investigated independently, in general, from the same set of experiments. When polyurethanes are strained macroscopically, the individual segment orients and deforms in a manner which is characteristic to the morphological state of the material. In order to understand the internal structure and also the relationship between structure and properties, the deformation behavior of the separate components must be characterized.

Considerable amount of studies have been carried out to comprehend the structure property relationship of thermoplastic elastomers. It is generally accepted that the elastic properties of the segmented polyurethanes are mainly due to the phase separated heterogeneous structure. Since the response of each part of heterogeneous material can be very different depending on the material properties of each phases, he deformation behavior of the heterogeneous material is extremely complicated. Therefore, the information on the orientational behavior of all parts of the molecule has to be combined in order to understand the overall response of the material upon deformation. Since infrared spectroscopy can be used to study the orientation behavior of each of the individual functional groups, it has been extensively used in the study of the orientational properties of polyurethanes.

In this talk, the molecular orientation of the hard and soft domains will be analyzed to study the characteristic responses when stressed. Infrared dichroism is extensively used to monitor the local segmental orientation. The experimental dichroic values are compared with the theoretical values obtained from the network deformation theory which is modified for thermoplastic elastomers.