

## Linear IR dichroism of polyether-based polyurethane-silica nanocomposites

L. Bistričić<sup>1</sup>, M. Leskovic<sup>2</sup>, G. Baranović<sup>3</sup>, E. Govorčin Bajsić<sup>2</sup>

<sup>1</sup>*Department of Applied Physics, Faculty of Electrical Engineering and Computing, University of Zagreb, Unska 3, 10000 Zagreb, Croatia*

<sup>2</sup>*Faculty of Chemical Engineering and Technology, University of Zagreb, Marulićev trg 19, 10000 Zagreb, Croatia*

<sup>3</sup>*Ruđer Bošković Institute, P.O.B. 1016, 10001 Zagreb, Croatia  
lahorija.bisticic@fer.hr*

Polymer nanocomposites are new class of materials with improved physical (thermal, mechanical, dielectric and magnetic) properties due to the interaction between polymer matrix and nanofillers. In this work, two polyether based polyurethanes (ETPU-1, ETPU-2) with different ratios of hard/soft segment contents have been synthesized using 4,4'-diphenylmethane diisocyanate (MDI), poly(oxytetramethylene) glycol (PTMO) of 1000 molecular weight and 1,4-butane diol as chain extenders. In ETPU-1 and ETPU-2 the molar ratio of NCO to OH groups in prepolymers was kept 4/1 and 2/1, respectively. Two series of ETPU-1 and ETPU-2 silica nanocomposite thin films were also prepared with addition of 0.5, 1 and 3% volume fraction of silica nanoparticles.

Mechanical and FTIR investigations were performed on neat ETPU and ETPU-silica nanocomposite thin films in order to understand how the ratio of hard/soft segment contents and the presence of nanofiller influenced mechanical properties. Introduction of the nanosilica into ETPU matrix changed both tensile strength and elongation at break.

The orientation of hard and soft segments, as well as the phase separation, was studied by FTIR linear dichroic measurements performed on stretched films [1]. The analysis of C=O stretching vibrations yielded information about the hydrogen bonding between different segments in neat ETPU polymers and nanocomposites. The degree of phase domain separation (DPS) was calculated from the integrated intensities of the absorbance bands observed at 1732 and 1703 cm<sup>-1</sup>, which were attributed to the free and hydrogen bonded carbonyl groups, respectively. The analysis has indicated that DPS depends on the hard/soft segment ratio and inter-segment interactions. In ETPU-1 neat film with higher concentration of hard segments DPS was 69%. The lower concentration of hard segments in ETPU-2 reduced the DPS to 61%. The addition of small amount of nanosilica increased the DPS in thin films of ETPU silica nanocomposites, especially in ETPU-1. This enhancement is an obvious consequence of interactions between polymer chains and nanosilica particles.

[1] L. Bistričić, M. Leskovic, G. Baranović, S. Lučić Blagojević, J. Appl. Polym. Sci. 108 (2008) 791-803.