

# Structure and dynamics in polyester based nanohybrids

K. Androulaki<sup>\*1,2</sup>, K. Chrissopoulou<sup>2</sup>, S. H. Anastasiadis<sup>1,2</sup>

<sup>1</sup>*Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas, Heraklion Crete, Greece*

<sup>2</sup>*Department of Chemistry, University of Crete, Heraklion Crete, Greece*

D. Prevosto, M. Labardi

*CNR-IPCF, c/o Physics Department, University of Pisa, Pisa, Italy*

Polymer dynamics in the bulk and, more recently, under confinement, is of great interest both because it greatly affects many of their macroscopic properties and because of the complexity it exhibits over many length- and time-scales. [1,2] Moreover, the behavior of polymers in the bulk appears to be very different from that close to interfaces. Intercalated polymer / layered silicate nanohybrids (PLSN) offer a unique avenue to study the behavior of macromolecules in nanoscopic confinement. [3,4] At the same time, biodegradable polymers have attracted considerable attention as green materials and biomaterials in pharmaceutical, medical, and biomedical applications. In particular aliphatic polyesters, due to their biodegradability and biocompatibility, are one of the most important classes of synthetic biodegradable polymers.[5] On the other hand, hyperbranched polymers are a new class of materials which hold promises for a broad range of applications due to their shape, the large number of functional groups together with their cost-effective synthesis, as compared to dendrimers. [4]

In the present work, the effect of polymer / surface interactions on the structure and dynamics of two linear polyesters with hydroxyl end-groups (EG110, DG110) and of three different generations of a hyperbranched polyester polyol (Boltorn™) when mixed with layered silicates is investigated. A series of nanohybrids with different polymer content was synthesized. Their structure is determined by X-ray diffraction (XRD) and the thermal properties by Differential Scanning Calorimetry (DSC). In all cases, intercalated nanocomposites are obtained and all the thermal transitions are suppressed in hybrids, where all polymer chains are inside the galleries of the clay. Broadband Dielectric Spectroscopy (BDS) was utilized to study the relaxation processes of the polyesters and the respective nanohybrids, at a broad range of temperatures both in the bulk and under severe confinement between the layers of sodium montmorillonite, Na<sup>+</sup>-MMT. For the linear polyesters under confinement, the local motions exhibit lower activation energy with respect to the bulk, whereas the segmental process becomes slower. These results are compared to the respective of the hyperbranched polyesters, which bears different architecture and thus exhibits different interactions with the surface.

## References

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\* krysand@iesl.forth.gr