



Polymer Nanocomposites: Correlating Structure, Dynamics and Properties

K. Chrissopoulou^{1#*}, F. Krasanakis¹, M. Stylianakis¹, H. Papananou^{1,2}, K. Androulaki^{1,2}, E. Giannakaki^{1,2}, F. Gojda^{1,3}, I. Karnis^{1,2}, Th.-M. Chatzaki^{1,2}, G. Markozanne^{1,2}, A. Kadianaki^{1,2}, K. Giannaris^{1,4}, K. Plexousaki^{1,2} and S. H. Anastasiadis^{1,2}

¹ Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas, Heraklion Crete, Greece

² Department of Chemistry, University of Crete, Heraklion Crete, Greece

³ Department of Physics, University of Crete, Heraklion Crete, Greece

⁴ Department of Materials Science and Technology, University of Crete, Heraklion Crete, Greece

Presenting author: K. Chrissopoulou, email: kiki@iesl.forth.gr

* Corresponding author: K. Chrissopoulou, email: kiki@iesl.forth.gr

ABSTRACT

Polymer materials are often filled with inorganics to improve their properties. The cases in which the additive exists in the form of a fine nm-sized dispersion within the polymeric matrix, thus producing a *nanocomposite*, allow the investigation of basic scientific problems. At the same time, the behavior of polymers restricted in space or close to surfaces/interfaces can be very different from that in the bulk.

The investigation of the structure, morphology, chain conformations and dynamics of hydrophilic polymers in nanohybrids containing either layered materials or spherical nanoparticles will be presented. Mixing polymers with layered additives can lead to intercalated hybrids when the interactions between the constituents are appropriate; these can serve as model systems for the investigation of the static and dynamic properties of macromolecules in nano-confinement. On the other hand, using nanoparticles of largely different sizes provides the opportunity to vary the confining length as well the chain adsorption capacity. [1,2] The thermal, surface, self-healing and rheological properties are investigated in an attempt to understand the relationship between the physicochemical attributes of the constituents and the final properties of the hybrids which is of great importance for the design of new materials. Additionally, polymer dynamics close to surfaces or when chains are restricted in space can be very different from that in the bulk. The confined polymer dynamics is probed utilizing polymers with different hydrophilicity, functional groups and/or different architectures to investigate the influence of the interactions between the constituents and the geometry and size of the additive on the different relaxation processes. [3]

REFERENCES

- [1] Rissanou A. N., Papananou H., Petrakis V. S., Doxastakis M., Andrikopoulos K. S., Voyiatzis G. A., Chrissopoulou K., Harmandaris V. and Anastasiadis S. H. 2017. *Macromolecules* **50**, 6273-6284.
[2] Papananou H., Perivolari E., Chrissopoulou K., and Anastasiadis S. H. 2018. *Polymer* **157**, 111-121.
[3] Chrissopoulou K. Androulaki K., Labardi M. and Anastasiadis S. H. 2021. *Polymers* **13**, 2008.