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***«Molecular dynamics at nanometric length scales»***

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**Αίθουσα Σεμιναρίων Τμήματος Φυσικής**

**Βιβλιοθήκη - κτίριο Φ2 - 3ος Όροφος**

**Molecular dynamics at nanometric length scales**

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The question on what length-scale molecular and especially glassy dynamics of polymers takes place is of fundamental importance and has multifold practical implications as well. Recent results based on Broadband Dielectric Spectroscopy [1] for nanometric thin (≥5 nm) layers of poly(styrene) [2], poly(*cis*-1,4-isoprene) [3], poly(styrene‑b‑1,4-isoprene) diblock copolymers [4] and even for isolated chains [5] and for brushes of poly(2-vinylpyridine) in the dried [6] and swollen [7] state will be presented, delivering the concurring result that deviations from glassy dynamics of the bulk never exceed margins of ±3 K *independent* of the layer thickness, the molecular weight of the polymer under study and the underlying substrate. - The experiments lead to the conclusions that glassy dynamics takes place on the length scale a few polymer segments (≤ ~ 1nm), while the conformation of the chain as a whole is strongly modified by the geometrical confinement. The results will be discussed with respect to the highly controversial literature [8,9].

**References**

1. Kremer,F., A. Schönhals (Eds.) *Broadband Dielectric Spectroscopy*, Springer, Berlin 2003
2. Tress, M., M. Erber, E.U. Mapesa, H. Huth, J. Müller, A. Serghei, C. Schick, K.-J. Eichhorn, B. Voit and F. Kremer, “*Glassy Dynamics and Glass Transition in Nanometric Thin Layers of Polystyrene*“, *Macromolecules,* **43**, 9937-9944 (2010)
3. Mapesa, E.U., M. Tress, G. Schulz, H. Huth, C. Schick, M. Reiche, F. Kremer “*Segmental and chain dynamics in nanometric layers of poly (cis-1,4-isoprene) as studied by Broadband Dielectric Spectroscopy and temperature-modulated Calorimetry*”, *Soft Matter,* 10592-10598 (2013)
4. Kipnusu, W.K., M.M. Elmahdy, E.U. Mapesa, J. Zhang, W. Böhlmann, D.-M. Smilgies, C.M. Papadakis, F. Kremer *“Structure and Dynamics of Asymmetric Poly(styrene-b-1,4-isoprene) Diblock Copolymer under 1D and 2D Nanoconfinement”*, *ACS Appl. Mater. Interfaces*, **7**, 12328-12338 (2015)
5. Tress, M., E.U. Mapesa, W. Kossack, W.K. Kipnusu, M. Reiche, F. Kremer, *“Glassy Dynamics in Condensed Isolated Polymer Chains”, Science*, **341,** 1371-1374 (2013)
6. Neubauer, N., R. Winkler, M. Tress, P. Uhlmann, M. Reiche, W.K. Kipnusu, F. Kremer, *“Glassy dynamics of Poly(2-Vinyl-Pyridine) brushes with varying grafting density”*, *Soft Matter,* **11**, 3062-3066 (2015)
7. Neubauer, N., M. Tress, R. Winkler, E.U. Mapesa, W.K. Kipnusu, P. Uhlmann, F. Kremer *“Molecular Dynamics of Swollen Poly(2-vinylpyridine) Brushes” Macromolecules*, **49**, 6101-6105 (2016)
8. Kremer, F. (Ed.) “*Dynamics in geometrical confinement*”, Advances in Dielectrics, Springer 2014
9. Kremer, F., M. Tress, E.U. Mapesa; *“Glassy dynamics and glass transition in nanometric layers and films: A silver lining on the horizon”*, *Journal of Non-Crystalline Solids,* **407**, 277-283 (2015)