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Single molecule fluorescence microscopy- An application in thin polymer film dynamics.

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With worldwide production of polymers pegged at over 300 million tonnes (2017), there's need for sustainable options for production, waste management and recycling of polymers [1]. This high demand of polymers has made them become one of the most important materials in various industrial and biomedical sectors. These materials have shown interesting and unique physical properties that change drastically such as conductivity, viscosity and thermal expansion below, near and above the glass transition temperature which originate from complicated relaxation processes of polymer chains [2]. However these unique properties have not yet been fully understood despite experimental and theoretical studies of the glass transition temperature of polymers over the past decades. Thus there has been a need in polymer research to further understand the dynamics connecting the macroscopic and microscopic properties of polymers. Different experimental methods have been used to try and understand the nano-environment of polymers. One of these methods also used in this research is single molecule fluorescence microscopy. It is a powerful imaging tool that enables the direct observation of single fluorescent molecules in their nano-environment [3]. For this research, the diffusion of single fluorescent dye molecules embedded in thin polystyrene and poly (isobutyl methacrylate) films was used to study and investigate the dynamics of the thin polymer films. In this presentation, dynamics of the thin polymer films below and near the glass transition temperature as derived from the probe molecule diffusion will be discussed.

[1]. Plastics Europe, PEMRG,2017.
[2]. B. Flier, et al. "Heterogeneous Diffusion in Thin Polymer-Films as observed by High-Temperature Single Molecule Fluorescence Microscopy"; J. Am. Chem. Soc.,134,480-488, 2012.
[3]. Dominik Woll et al, "Polymers and single molecule fluorescence microscopy, what can we learn?",Chem.Soc.Rev,vol 38,pp313-328, 2009.

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