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Structure and dynamics in ultra-thin films of poly(alkyl methacrylate) prepared by spin-coating method

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Polymer materials have been used widely in our daily life, and they are used often as an ultra thin film with a thickness less than 100 nm. Such the thickness is comparable to the size of a single polymer chain; therefore, the conformation and molecular motion in an ultra-thin film should be constrained. Because the unique properties of polymer materials originate from the large degree of freedom of a polymer chain, various properties of an ultra-thin film would be different from those in a bulk state. However, the details on the polymer dynamics in a confined space is still unclear because the limitation of experimental methods. In this work, the dynamics in polymer thin films was studied in terms of the direct observation of single polymer chain.

In order to discuss the structure and dynamics of a single polymer chain, the fluorescence-labeled polymer was employed. The fluorescent moiety was introduced to the side chain of the polymer at a fraction as low as 1%. The labeled chain was dispersed in an un-labeled matrix to observe an isolated polymer chain in a fluorescence microscopy image. Conventional fluorescence microscopy has a limited spatial resolution of > 200 nm; therefore, the structure of single polymer chain cannot be directly observed. In the current work, a sup-resolution optical microscopy was used for the direct observation of individual polymer chains. In this talk, I introduce a super-resolution microscopy technique as a novel tool to study polymer materials at the single molecule level and its application to the investigation of ultra-thin films of poly(alkyl methacrylate) prepared by spin-coating method.

Biography

Hiroyuki Aoki is a Senior Scientist in Materials and Life Science Division, J-PARC Center, Japan Atomic Energy Agency. He obtained his degrees of BE, ME, and PhD from Kyoto University in 1996, 1998, and 2001, respectively. He became an Assistant Professor of Department of Polymer Chemistry, Kyoto University in 2001 and promoted to an Associate Professor in 2006. In 2016, he moved to J-PARC as a Senior Scientist. His research interests are focused on structure and dynamics of polymer thin films. He was awarded Inoue Research Award for Young Scientist from Inoue Foundation for Science (2002), Young Scientist Lectureship Award (2008), SPSJ Award for the Outstanding Paper in Polymer Journal (2008), and Science Award from Society of Polymer Chemistry, Japan (2016). His Research includes polymer physics, thin film, single molecule detection, super-resolution microscopy, neutron reflectometry

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