Poster Presentation

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Dynamics of nanoparticles in elongated rubber investigated with heterodyne XPCS

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Addition of nanoparticles into rubber is indispensable process for production of rubbery materials, as it improves the viscoelastic and mechanical properties of rubber (reinforcement effect). However, the understanding of reinforcement effect is far from satisfactory in spite of many studies. Further microscopic-scale investigation is required for controlling and improving the properties of rubbery materials. Aiming to construct a microscopic model of filled rubber under elongation, we have investigated nanoparticle dynamics in uniaxially stretched rubber using heterodyne X-ray photon correlation spectroscopy (heterodyne XPCS)[1] at BL03XU, SPring-8, Japan. In heterodyne XPCS, information on the fluctuating and dissipative dynamics of nanoparticles and that on their advective motion are separately extracted from the time correlation of X-ray scattering intensity. The results of heterodyne XPCS experiments showed that the direction of nanoparticles' advective motion corresponds to the macroscopic deformation of the sample in stress relaxation process. Furthermore, we found that chemical bond between nanoparticle and rubber polymer influences the dynamics of nanoparticles. In this presentation, we will show detailed analysis of the heterodyne XPCS results and discuss a microscopic description of filled rubber under elongation. This study was conducted under the approval of the SPring-8 Proposal Advisory Committee (2013A7210, 2013B7259).

[1] *F. Livet, F. Bley, F. Ehrburger-Dolle et al., Journal of Synchrotron Radiation, 2006, 13, 453-458*

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