Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Translational and Rotational Motion of Nanocrystals in Rubber
YUYA SHINOHARA, AKIRA WATANABE, The University of Tokyo, HIROYUKI KISHIMOTO, Sumitomo Rubber Industries Ltd., YOSHIYUKI AMEMIYA, The University of Tokyo — We present the observation of translational and rotational dynamics of carbon-black nanocrystals in styrene-butadien rubber using coherent X-ray scattering. X-ray photon correlation spectroscopy (XPCS) exploits the partial coherence of X-rays to provide the information of microscopic dynamics. In diffracted X-ray tracking (DXT) measurement, the motion of diffraction spots from single nanocrystals is monitored to track their rotational motion. A combination of XPCS and DXT reveals the detailed translational and rotational motion of nanocrystals in a medium. Experimentally XPCS requires a monochromatic beam whereas DXT requires a wide energy range to increase the probability of diffraction spots being on the Ewald sphere shells. This experimental incompatibility can be overcome by using an intense pink beam X-ray that is available using a helical undulator at synchrotron facilities.

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Date submitted: 06 Nov 2013 Electronic form version 1.4