Exciton dynamics of colloidal perovskite nanoparticles by femtosecond light scattering microscopy

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Hybrid inorganic–organic solar cells with organometal trihalide perovskite as light absorbers have been attracting much attention because of their large power conversion efficiencies exceeding to 20%. It has been reported that structural properties of the perovskite layer are of crucial importance for the high performance of the device. The relation between morphology and exciton dynamics in organometal trihalide perovskite crystal has been unclear [1]. Investigating each single nanoparticle is an ideal experimental system to study the relationship between morphology and exciton dynamics. In the present study, we developed widefield femtosecond transient absorption microscopy to investigate single nanoparticles. The femtosecond microscopy was applied to examine the exciton dynamics of colloidal perovskite nanoparticles prepared by a solvent-assisted reprecipitation method.

Figure 1 (a) shows a total interfacial reflection scattering image of $CH_3NH_3PbBr_3$ quantum dots (QDs) adsorbed on a glass plate in toluene solution. Scattering image of the nanoparticles was monitored at 515 nm. Figure 1 (b) shows time profiles of scattering intensity of $CH_3NH_3PbBr_3$ QDs at each position. Hence, $\Delta Scat. = (I - I_0) / I_0$ [2]. Each signal polarities at 515 nm were different with positions. Femtosecond transient absorption spectra of $CH_3NH_3PbBr_3$ QDs were also measured with different nanoparticle sizes. From these results, it is expected that the difference of the signal polarities is probably due to the difference of the NPs size. The details of the data will be discussed on conference site.

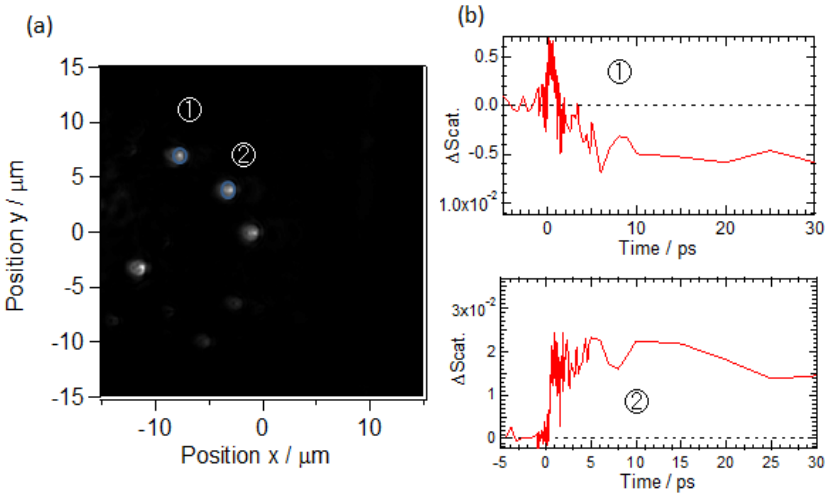

Figure 1. (a) Total interfacial reflection scattering image of $CH_3NH_3PbBr_3$ QDs adsorbed on a glass plate in toluene solution. (b) Time profiles of transient scattering signals at each position (λ_{ex}= 480 nm, λ_{obs}= 515 nm).

References

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