Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Dynamics of charge separation and multicarrier recombinaiton in CdS/CdTe heterodimer nanocrystals SEIJI TAGUCHI, Institute for Chemical Research, Kyoto University, MASAKI SARUYAMA, University of Tsukuba, TOSHIHARU TERANISHI, YOSHIHIKO KANEMITSU, Institute for Chemical Research, Kyoto University — Heterostructured semiconductor nanocrystals provide new ways to manipulate electronic wave functions and carrier recombination pathways. Recently, we developed a novel anion exchange reaction and synthesized anisotropically phase-segregated CdS/CdTe heterodimers with staggered band-edge alignment [1]. Here we report the ultrafast carrier dynamics in the heterodimers measured by transient absorption spectroscopy. While pump laser energy was tuned to create excitons only in the CdTe phase, we observed the bleaching of the CdS excitonic transition. The bleaching of CdS exciton states should be induced by electron injection from the CdTe phase to the CdS phase. Very rapid electron transfer time was evaluated to be about 400 fs. Moreover we found that temporal evolutions of CdS excitonic bleaching are almost independent of excitation intensity over a wide range, implying the suppression of Auger recombination. Our results indicate that charge separation efficiency of the heterodimers is enhanced due to their centrosymmetry-broken structures, and the designed nanocrystals are useful for next generation solar cells. [1] Saruyama et al., J. Am. Chem. Soc. 133, 17598 (2011).

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Date submitted: 11 Nov 2011 Electronic form version 1.4