

Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Study on silicon nanocrystals and polymer bulk heterojunction structures MICHIIHIRO SUGAYA, YI DING, SHU ZHOU, TOMOHIRO NOZAKI, Tokyo Institute of Technology — Silicon nanocrystals (SiNCs) and semiconductor-polymer (P3HT) nanostructured thin film is investigated for better understanding of bulk heterojunction structure of hybrid solar cell and improving its photon-to-electron conversion performance. SiNCs are synthesized by VHF plasma CVD using silicon tetrachloride. SiNC thin film transistor (TFT) was fabricated to investigate carrier transport properties of SiNC network. As a result, hydrogen-terminated SiNCs behave as n-type semiconductor materials, and electron mobility of SiNC network is improved dramatically. In contrast, chlorine-terminated SiNCs behave as metallic materials and show poor electron transport property because of surface doping effect: electrons are not flow over the SiNC network due to a large electronegativity of chlorine. Additionally, when the chlorine-terminated SiNCs are blended with P3HT, new peaks appear in FTIR absorption spectrum. The result implies that the thiophene structure, which forms the hole transporting pathway, may be damaged by highly reactive surface chlorine and therefore the hole transport property of Cl:SiNCs/P3HT blended film would be deteriorated dramatically. These results are well correlated with Cl- and H-terminated/P3HT hybrid solar cell performance.

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Date submitted: 17 Jun 2015

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