Proceedings of the 5th International Conference on Nanotechnology: Fundamentals and Applications
Prague, Czech Republic, August 11-13, 2014
Paper No. 311

Nanocrystalline Semiconductor-based Inorganic/Organic Hybrid Solar Cells

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Extended Abstract

Until now, innovative solar energy transforming devices such as dye-sensitized solar cells, organic solar cells, and inorganic-organic hybrid hetero-junction solar cells using inorganic nanocrystalline semiconductors and quantum dots showed outstanding performance. However, significant improvements to the efficiency of solar cells could be possible in the near-future by advent of new technologies or materialsIt. Under ambitions for fabricating stable, high–efficiency, and cost-effective solid-state solar cells, We established new approaches for the production of inorganic-organic hybrid solar cells employing nanocrystalline Sb_2S_3 (Sb_2Se_3) and chemically managed inorganic/organic hybrid perovskite materials as light harvesters with organic hole conducting materials.

As results, we achieved unprecedented success in the performance. The surface sulfurization and combination of Sb_2S_3 and Sb_2Se_3 as sensitizer showed the efficiency exceeding 8 % under 1 sun irradiation with a metal mask. In inorganic-organic hybrid perovskite materials, a solvent-engineering technology enabled the extremely uniform, dense perovskite layers, and remarkably improved the performance of the cells with a certified power conversion efficiency (PCE) of 17.9% under air-mass 1.5 global (AM 1.5G) illumination of 100 mW cm^{-2} intensity. The PCE is the highest value ever reported for each system. These results will lead to more efficient and cost-effective inorganic-organic hybrid heterojunction solar cells in the future.

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