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Solution Phase Inorganic Ligand Exchange for Fabrication of Ink Based Quantum Dot Thin Films

Hossein Beygi[1], Seyyed Abdolkarim Sajjadi[2], Abolfazl Babakhani[3], Jeff F. Young[4], Frank C. J. M. van Veggel[5]

1, 2, 3- Department of Materials Science and Metallurgical Engineering, Engineering Faculty, Ferdowsi University of Mashhad, Mashhad, Iran.

4- Department of Physics and Astronomy, University of British Columbia, Vancouver, British Columbia, Canada V6T 1Z1

5- Department of Chemistry, University of Victoria, Victoria, British Columbia, Canada V8W 3V6

beygi@alumni.ubc.ca

Abstract

PbS quantum dots are the main part of such cells which absorb the photons, turn it into electron-hole pairs and transferred them to the side electrodes. However, during the application of such structure in air atmosphere, QDs immediately destroyed due to their weak oxidation stability. Surface defects increases the density of nanoparticles surface damages and lead to charge carrier's recombination, which ultimately reduces the cell's performance. Photoluminescence measurements indicated that solution phase exchange of oleic acid to iodide based ligands improved air exposure oxidation of solid films. FTIR and XRD analyses also confirmed successful ligand exchange process and QDs stability in air. Subsequently, such prepared inks are used to fabricate quantum dot thin films.

Keywords*:* PbS quantum dot, Ligand exchange, Oxidation, Thin film.

Introduction

Quantum dot solar cells (QDSCs) with less than 1% efficiency were introduced first in 2008 and recent progresses in this field leads to their efficiency increase up to 11.6% in 2016 [۲ ,۱]. PbS(Se) quantum dots (QDs) are the main part of such cells that absorb photons of light, turn them into electron-hole pairs and transfer them to the side electrodes [٤ ,۳]. QDSCs have great features regarding to the special properties of QDs; capability of using wide range of solar spectrum due to quantum confinement, more photon absorption due to the high surface to volume ratio of

[1] - PhD Student in materials science and metallurgical engineering

[2] - Professor in materials science and metallurgical engineering

[3] - Associate professor in materials science and metallurgical engineering

[4] - Professor in physics

[5] - Professor in chemistry