The College of Graduate studies and the College of Science Cordially Invite You to a

Master Thesis Defense

Entitled

FABRICATION AND CHARACTERIZATION OF PEROVSKITE STRUCTURES FOR SOLAR CELL APPLICATIONS

By

Asma Obaid Said Al Ghaithi

Faculty Advisor

Dr. Adel Najar, Department of Physics

College of Science

Date & Venue

10:00 AM

Thursday, 9 April 2020

Link: https://eu.bbcollab.com/guest/e87c2c17f3ed49ebb418c7aaf79744fe

Abstract

Solution-processing organic–inorganic hybrid perovskites have emerged as new generation and promising light-harvesting materials for photovoltaic technology and photonic applications such as solar cells, light emitting diodes and laser. The aim of this thesis is to boost the power conversion efficiency of planer perovskite solar cell by either using perovskite nanostructured layer, or by doping perovskite thin film with metal ion to enhance the morphological, structure and optical properties of the perovskite thin film. The first proposed perovskite layer is based on CH3NH3PbBr3 and fabricated using one-step self-assembly method. The method is appropriate to produce CH3NH3PbBr3 microstructures in form of micro-wires, microplates and micro-cubes. The microstructures exhibit a cubic phase structure and the growth start from the periphery and propagate to the center, giving forms of hollow cubes when the growth is not finished, and each cube is the superposition of several perovskite layers. The optical properties show an absorption peak at 523 nm and emission peak at 537 nm. In the other hand, the second layer is based on CH3NH3PbI3 thin film doped with the monovalent metal ions Cu^{+} and Ag^{+}, that is fabricated using one-step solution process. The results indicate that doping CH3NH3PbI3 thin film with small amount of Cu^{+} and Ag^{+} ions have modified the morphology and structure of the perovskite layer by enhancing the surface coverage and the perovskite conversion process. While the optical properties show an improvement in the absorption and PL intensities. Based on these results, we chose to synthesis perovskite solar cell using CH3NH3PbI3 thin film doped with different amount of Cu^{+} ions to investigate the consequence of altering the concentration of the metal ions on the performance of the perovskite solar cell. We found that doping perovskite solar cell with small amount of Cu^{+} ions has increased the power conversion efficiency of the solar cell from 16.33% to 18.17%, while the excessed amount of Cu^{+} ions has given completely a different effect on the morphological and optical properties of the perovskite thin film which led to a decrease in the power conversion efficiency of the perovskite solar cell to 4.41%.

Keywords: Perovskite, thin film, microstructure, Perovskite solar cell