ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ
ΤΜΗΜΑ ΕΠΙΣΤΗΜΗΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑΣ ΥΛΙΚΩΝ

ΠΑΡΟΥΣΙΑΣΗ ΜΕΤΑΠΤΥΧΙΑΚΟΥ ΔΙΠΛΩΜΑΤΟΣ ΕΙΔΙΚΕΥΣΗΣ

Τίτλος

«Photon Management in Thin Film Solar Cells»

Περράκης Γεώργιος

Μεταπτυχιακός Φοιτητής

Τμήματος Επιστήμης και Τεχνολογίας Υλικών, Πανεπιστημίου Κρήτης

Επιβλέπουσα Καθηγήτρια κ. Μ. Καφεσάκη

Πέμπτη, 21/04/2016,

12:00 π.μ.,
Αίθουσα Β2,
Κτίριο Χημείας,

Πανεπιστήμιο Κρήτης

Abstract

Due to the limitation and the rising cost of the fossil fuel supplies as well as the advances in nanotechnology, solar cells continue to be a hot topic nowadays. There is though a need for the solar cells to become thinner so as to reduce the cost and to minimize the charge carrier (electrons-holes) recombination before collection.

However, one of the largest drawbacks of thin film solar cells is the very small interaction time of the incoming wave with the absorbing layer, resulting to small absorption, and thus small current generated by the cells and small cell efficiency. One way to face this problem is to exploit the possibilities offered by the field of plasmonics, i.e. involvement of surface plasmon polariton (SPPs) structures in the solar cells. SPPs, both propagating and localized, are associated with high local fields and strong scattering, and have been shown unique in guiding and confining light at the nanoscale, being thus promising for enhancing the absorption inside thin film solar cells.

In this work we study the possibilities and potential of plasmonic nanostructures embedded in silicon thin film solar cells to increase the absorption properties of the solar cells, and thus the solar cell efficiency. More specifically three approaches for enhancing absorption are examined. In the first approach, we examine the Localized Surface Plasmon Resonances (LSPRs) supported by metallic nanoparticles of different shapes and sizes and in different positions in the cells. In the second, we examine the Surface Plasmon Polaritons (SPPs) excited in the silicon-back-reflector interface when the interface is periodically nanostructured. In the third approach, metallic and/or dielectric nanoparticles are placed on top of the solar cell and their potential to minimize the solar cell back reflection (enhancing thus the absorption) is examined.

As the above study showed, all the above approaches can constitute promising paths to increase the thin film solar cell efficiency.