ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ
ΤΜΗΜΑ ΕΠΙΣΤΗΜΗΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑΣ ΥΛΙΚΩΝ

ΠΑΡΟΥΣΙΑΣΗ ΜΕΤΑΠΤΥΧΙΑΚΟΥ ΔΙΠΛΩΜΑΤΟΣ ΕΙΔΙΚΕΥΣΗΣ

Τίτλος

«2D Nanosheets as charge transport layers in perovskite solar cells»

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Δευτέρα, 15/10/2018,

3:00 μ.μ.,

Αίθουσα Φ2,
Κτίριο Τμήματος Φυσικής,
Πανεπιστήμιο Κρήτης

Metal halide Perovskite Solar Cells are considered the most promising cost-effective photovoltaic technology as they employ ultra-low cost solution-processed semiconductor materials with very unique optoelectronic properties. Additionally, the progress of their PCEs present the steepest rise of any other photovoltaic technology. The perovskite crystalline structure follows the formula ABX3 where A is a small cation, B is a large metal cation, and X is a halogen anion. The two main geometries in which the perovskite solar cells are nowadays constructed are the planar and the inverted one. The layers of the planar or inverted structure are: Anode/Electron Transport Layer/perovskite layer/Hole Transport Layer/Cathode or Anode/Hole Transport Layer/perovskite layer/ Electron Transport Layer/Cathode, respectively. Each material and each layer play a significant part so that the layout to work more effectively.

At this project, we have used the inverted structure because over the years the use of the PC60BM as the Electron Transport Layer reduced the imperfections on the perovskite's surface resulting in negligible hysteresis in the efficiency measurements. Changing the hole transport layer with a 2D dimensional material can result in a higher efficiency due to a better extraction of electrons, higher mobility of charge carries and a better alignment of the energy levels. Two basic materials were used: 1) Graphene Oxide (GO) and 2) Tungsten Disulfide (WS2) nanosheets fabricated by spin coating and vacuum filtration so that both their surface's uniformity and characteristic values were assessed and tested. In the first case, the reference solar cells were fabricated with PTAA (widespread polymer) as the Hole Transport Material and in second case 2D materials were used for this layer to compare the electrical characteristics of the solar cells. Further characterization of the fabricated structures was performed by using Atomic Force Microscopy (AFM) and UV-visible Spectroscopy.