Abstract

This project is divided into three sections. Firstly, CdO and α-Fe2O3 NPs are prepared by the methods of Pulsed Laser Ablation in Liquid (PLAL) and Pulsed Laser Deposition (PLD). Nd:YAG laser is used with different laser fluencies (5, 5.5, 7, 8.5 and 9 J/cm2) at wavelength of (1064 nm) to irradiate the CdO and α-Fe2O3 targets for 200 pulses, Where the structural, morphological, optical and electrical properties of the prepared nanoparticles were studied using XRD, AFM, SEM, UV-Vis spectrophotometer and Hall Effect, respectively. Secondly, Porous Silicon (PSi) is fabricated using the electrochemical etching (ECE) method at current density of 50 mA/cm2 for 10 minutes using a mixture of Hydrofluoric acid: ethanol (HF: ethanol) with ratio of 2:1 to be used as a depositing substrate for solar cell fabrication. Finally, CdO and α-Fe2O3 NPs are deposited on the Porous Silicon to create the solar cells.

In both preparation techniques, Hall Effect measurements indicated that all the nanoparticles are N-type semiconductors. The XRD results showed that the prepared thin films were all crystallite structure with no impurity peaks of other elements. Also, their peak intensities increased with increasing the ablating laser fluence.

SEM and AFM measurements indicated that in Pulsed Laser Ablation in Liquid, as the laser fluence increased, the average diameter of prepared NPs decreases from 80.18 to 61.75nm in CdO and 96.27 to 67.86nm in α-Fe2O3, while the band gap energy increases from 2.48 to 2.81 eV in CdO and 1.94 to 2.32 eV in α-Fe2O3 nanoparticles. On the other hand, increasing the ablating laser fluence in Pulsed Laser Deposition results the average NPs diameter to increase from 60.52 to 114.4nm in CdO and 72.60 to 116.43nm in α-Fe2O3, causing the band gap

energy to decrease from 2.47 to 1.87 eV in CdO and 2.3 to 1.9 eV in α-Fe2O3 nanoparticles. As for the Porous Silicon, SEM and AFM results show that the pit depth is roughly 40.1 nm and the average pore diameter is 23.28 nm that falls within the mesoporous nanostructure classification.

Finally, the current density-voltage curves of the solar cell under illumination were studied. It's found that the CdO solar cells exhibited a higher efficiency than the α-Fe2O3 cells with better F.F results. At standard testing conditions, The Al/CdO NPs/PSi/P-Si/Al solar cell exhibits a conversion efficiency of 3.88% and F.F of 58.72% while Al/α-Fe2O3 NPs/PSi/P-Si/Al solar cell presents a conversion efficiency of 2.37% and F.F of 49.18% at higher nanoparticles concentration.