DESIGN, FABRICATION AND OPTIMIZATION OF THE PERFORMANCE OF SILICON SOLAR CELL USING MULTILAYERS OF POROUS SILICON

Submitted By

Hager Abd El-Hakim Mohamed Nawar

B.Sc. of Science (Physics), Faculty of Science, Ain Shams University, 2008

M.SC. in Environmental Basic Sciences, Institute of Environmental Studies and Research, Ain Shams University, 2014

A thesis submitted in Partial Fulfillment
Of
The Requirement for the Ph.D. Degree
In
Environmental Science

Department of Environmental Basic Sciences
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APPROVAL SHEET

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This thesis Towards a Doctor of Philosophy Degree in Environmental Science

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ABSTRACT

Porous silicon layer (PSL) has emerged in potential solar cell applications because of its high surface area to volume ratio, convenient surface chemistry and large energy band gap ≈1.9 eV.PSL has been prepared from n^+p/Si junction using electrochemical etching process (ECE) with three different current densities 25, 50 and 75 mA/cm^2 on the front and back side and 50 mA/cm^2 for both sides of the cell. The influence of varying current density on morphological, optical, chemical and electrical properties of PS has been inspected. SEM micrographs showed that the surface porosity of 90% on the front side, in contrast the etched back surface seemed in harmonic shape with identical pore size and porosity of 98%.XRD pattern of PSL formed on the front n-surface seems to be different from that formed on the back p-surface. This results from the dissimilar in surface morphology and the average nano crystallite sizes of samples. The PL spectrum peak ranged from 640 to 670nm. A reduction in light reflection of PSL samples by increasing in current density to 50 mA/cm² compared to un treated textured Si surface. The obtained FTIR spectra of the samples with a relatively high PL intensity exhibit a developed broad transmission bands in the range of 600 cm^{-1} to 4000 cm^{-1} this relatively attributed to the presence of both hydrogen and oxygen complexes. Solar cell conversion efficiency based on PSL formed on both sides shows a remarkable increase in its efficiency compared to that based on one side of the cell.

Abstract

From these results it reaches conclusion that solar cell based on PSL formed on both sides provide the best cell circuit parameters, offers stability, lower costs, and it is being recommended for industrial fabrication.

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