H. Arabshahi and Z. Momeni / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 3, Issue 4, Jul-Aug 2013, pp.1625-1626

The Theoretical Study of Affecting Factor on the Performance of Silica Solar Cells with P-N Junction

[1]Hadi Arabshahi, [2]Zahra Momeni and [2]Parisa Ashori
[1]Department of Physics, Payame Noor University, Tehran, Iran
[2]Department of Physics, Payame Noor University, Mashhad, Iran

ABSTRACT
In this study one–dimensional PC1D software is used to simulate the solar cell and the effect of different factors, such as anti –reflective coating; textured surface of cell and impurity of density on the performance and efficiency of solar cells has been studied. The result show that by increasing impurities, the open circuit voltage (Voc) increase and the short circuit current (I sc) decrease. The optimum amount of impurities, which is achieved the highest efficiency is about 1×1017cm^{-3}.

Keywords **–** Optimize of efficiency, anti-reflection coating, and solar cell.

I. INTRODUCTION

Solar cells are optoelectronic devices, which convert sunlight directly to electricity. Due to decrease of the fossil fuel reserves, the basic requirement for achieving these tools can be fully felt. Currently, due to the high costs of making these cells and the very low efficiency, use of these devices to produce energy is not economical. Solar cells are usually forms from a P-N bond. To make P-N bond, first, extract silicon from the soil, which is the most abundant element, and pure it about 99.9%. Ten it has been in single–crystal called crystalline and with the injunction of both impurities in it, and finally to bond P-N, phosphorus impurities are distributed over the surface of P [1].

T study the performance of these cells and the effect of various parameters on their performance and finally the designing of cells with better efficiency, some software is designed to examine the relationship of optoelectronic devices. After design and simulation of cells, according to scientific limits governing this device, the results are analyzed. One of the software that is designed to simulate the solar cell is PC1D, and one-dimensional software [2]. In this software, transport equations of charge carriers in the semiconductor and Poisson's equation are solved using Newton repetition and then the effect of parameters such as anti-reflective coating, the amount of impurities (base), the BFS factor, cell thickness, distribution of impurity phosphorus on emitter, carrier diffusion length and temperature on the cell performance of that with proper choice of parameters, the cell [3].

Comparing the efficiency of the cells with the specified characteristics which are simulated by software and cells mode in the laboratory with the Same characteristics, it can be seen that the obtained efficiency for laboratory cell is usually less than calculated efficiency.

One of the reasons which can be seen from this is that the small amount of sunlight that shines on the cell surface is absorbed by the anti- reflective coating, and this is not considered in the calculations. In practice is attempted to choose the appropriate thick ness of material to use in coating, so it can absorb as much as possible.

II. METHOD OF CALCULATIONS AND DISCUSSION

We consider four silica cells with a thickness of 300 cm and a specific base resistance of 0.8 Ω-cm which are on the average solar radiation intensity of 0.1 w/cm^2. We consider sample A as a cell which its emitter is impure the density of 1×1020 cm-3 and the depth of 0.5 cm and its upper surface has a constant reflection of 30 percent . We consider sample B as cell A with the difference that its surface is covered by a three –layer anti- reflective coating of MgF2/ZnS/Sio2 which is bring the reflections in the range of 600-1000 nanometers ware length to the amount of less than four percent [4].

Coating upper surface of cell by these layers considering the reflective index and the thickness of these layers increases the optical absorption coefficient and thus increase the number of generated electron – hole pairs and eventually leads to a significant increase in I se [5].

Also, because of Sio2 that acts as an insulating layer in a three–layer coating, speeds of recombination in the front surface of cell will decrease [6]. As a result, the reduction increases Voc about 7mV. Consider sample cell C with the characteristics of cell B. with the difference that we add BFS factor with the impurity density of 5×10^{19} m^{-3} and thickness of 5µm(BSF of a P-N bond cell means that a layer with high impurity (P+) is linked to the P district at a low surface of cell).Increasing of BSF in cell decrease the re combination in lower surface of cell and also the potential barrier height between the metal and the semiconductor can be increased by this factor [1]. So the reverse saturation current 10 is reduced and Voc is increased. Also considering junction at the bottom of the cell, we have contact with small ohmic resistance which is reduce power dissipation and improve efficiency of cell.

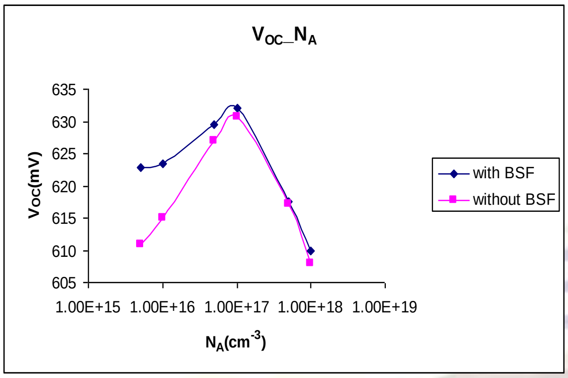

Fig 1. Change of Voc according to base impurity.

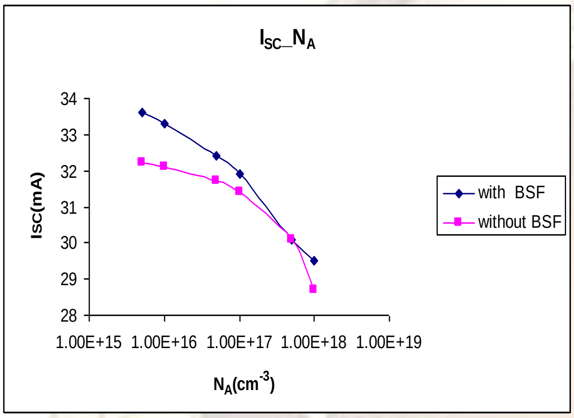

Fig 2. Changes in short circuit current according to changes in amount of impurity.

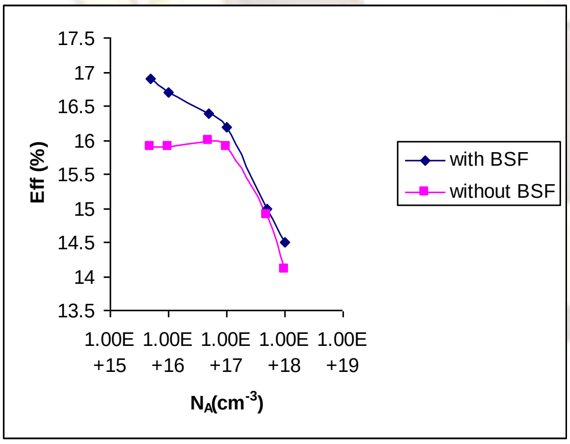

Fig 3. Changes in cell efficiency according to changing the amount of impurity.

REFRENCES

[1] M.A.Green; *"Solar Cell Operating Principles Technology and System Applications* ", (1982).

[2] D. A. Clugston, and P.A Basore, " *PC1D Version 5:32- bit solar cell simulation on Personal computers* ", Proc .26 TH IEEE Photovoltaic Specialists Conf. Anaheim CA (IEEE NewYork 1997) P.207. H. J. Hovel;" *Solar Cells, Semiconductor and Semimetals Series*" (New York, Academic press), (1975).

[3] A. Meijerink, R. E. L. Schropp, " *Modeling Improvement of Spectral Response of Solar Cells by Deployment of Spectral Converts Containing Semiconductor Nano-crystalline* "; 8 (2004).

[4] E. S. Heavens, *"Optical Properties of Thin Solid Films* ", (London, Butterwarths) (1955), See also http:// www.thinfilmcenter.com/.

[5] H.B.Serreze," *Optimization Solar Cell by Simultaneous Consideration of Grid Pattern Design and Interconnect Configuration*", pp. 609-614. (2002). [7] P. A. Bsore, "*Extended Spectral Analysis of Internal Quantum Efficiency*", 23rd IEEE PVSC, (1993), pp. 147-152.

[6] J. Streentman, "Solid State and Semiconductor Devices" (1978).