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RESEARCH ARTICLE

COMPARATIVE STUDY OF SHEET RESISTANCE BETWEEN SILICON DOPED N AND SILICON P IN DARK AND NO APPLY VOLTAGE

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Abstract

The aim of the study is to compare the sheet resistance between silicon doped n and silicon doped p at dark and no apply voltage.The sheet resistance ρsq at equilibrium is determined from the net ionised doping concentration and the mobility of the majority carriers.The calculator then determines the sheet resistance and the junction depth of the surface diffusion at outdoor temperature..The sheet resistance of silicon with background doped boron has great sheet resistance compared to silicon with background doped phosphorus.

Introduction:-

To maximizing absorption [1] and minimizing recombination [2], the final condition necessary to design a high efficiency solar cell [3] is to minimize parasitic resistive losses [4]. Both shunt [5] and series resistance [6] losses decrease the fill factor and efficiency of a solar cell. A detrimentally low shunt resistance is a processing defect rather than a design parameter. However, the series resistance, controlled by the top contact design and emitter resistance, needs to be carefully designed for each type and size of solar cell structure to optimize solar cell efficiency.

The series resistance of a solar cell consists of several components as shown in the diagram below. Of these components, the emitter [7] and top grid (consisting of the finger and busbar resistance) dominate the overall series resistance and are therefore most heavily optimized in solar cell design.

For the emitter layer, the resistivity as well as the thickness of the layer will often be unknown, making the resistance of the top layer difficult to calculate from the resistivity and thickness. However, a value known as the "sheet resistivity", which depends on both the resistivity and the thickness, can be readily measured for the top surface *n*-type layer [8]. For a uniformly doped layer, the sheet resistivity is defined as:

$\rho' = \frac{\rho}{t}$(1)

Where,
ρ is the resistivity of the layer; and
t is the thickness of the layer.

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Material and Method:-

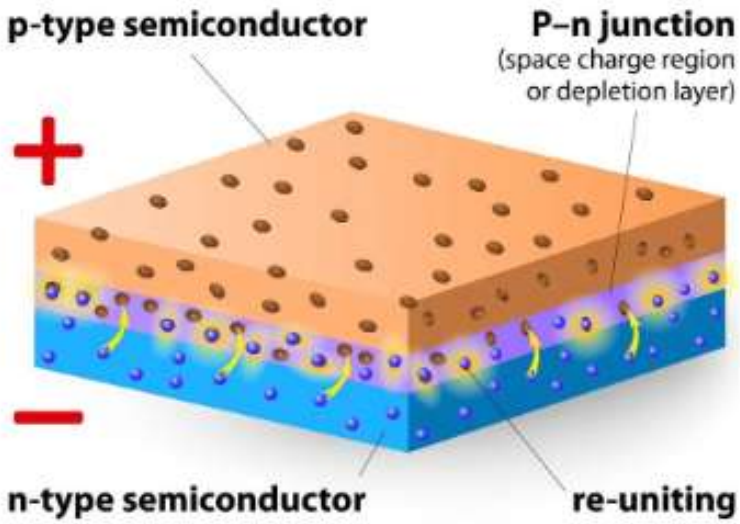

Figure 1:- P-N junctionsemiconductor.

The sheet resistanceρ_{sq} at equilibrium is determined from the net ionised doping concentration N(z) and the mobility of the majority carriersμ_{maj} by the equation.

$$\rho_{sq} = \frac{1}{q.\int_0^{Z_j} \mu_{maj}\ (Z).N(z).dz} \qquad (2)$$

where Z_j is the junction depth and q are the charge of an electron. The sheet resistance has the dimensions Ω/sq.

The net ionised doping concentration is defined as

N(z) = |NA(z) – ND(z)|, (3)

where NA and ND are the ionised concentration of acceptor and donor atoms. In the case of a silicon semiconductor. if the background and dopant profile are of opposite types, zj is the depth at which |NA(z) – ND(z)| equals zero; and if the background and dopant profiles are of the same type, zj equals the background thickness.

PC1D defines zf such that the ERFC equation have the simplest form.

ERFC: N(z) = Np · {1 –erf [(z –zp) / (zf·√2)]} (4)

Results and Discusions:-

The parameter values used in this model are:

The doping background concentration 10^{16} cm^{-3}

The dopind background thickness 180 um

The resistivity 1.45Ω.cm.

The material temperature is 300K

The set-up model implemented in the powerful calculators shows the following results.

The calculator simulates a four-point probe measurement of a surface diffusion, such as the emitter or the back-surface field of a photovoltaic solar cell.

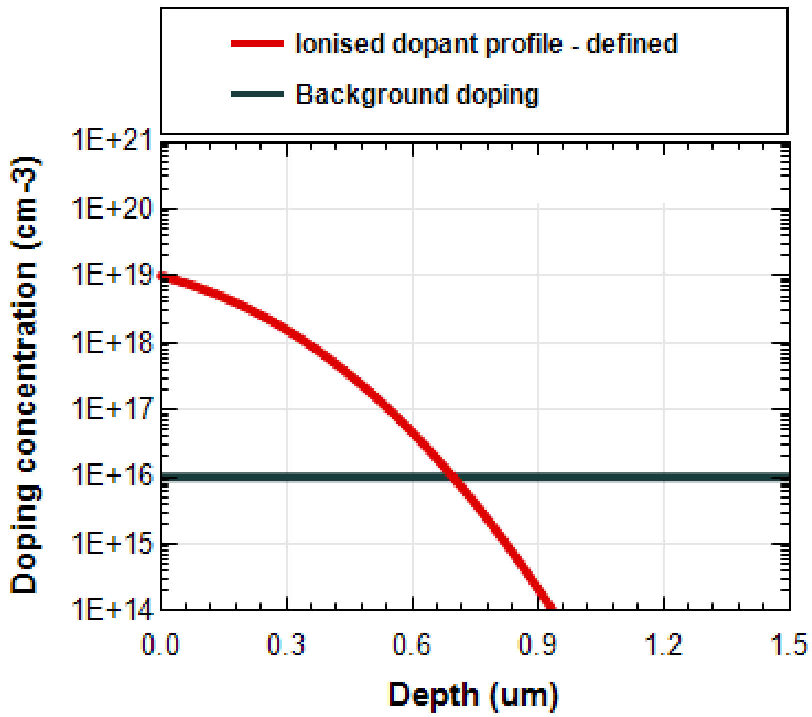

Figure 2:- Doping concentration for silicon with boron doped background versus the junction depth.

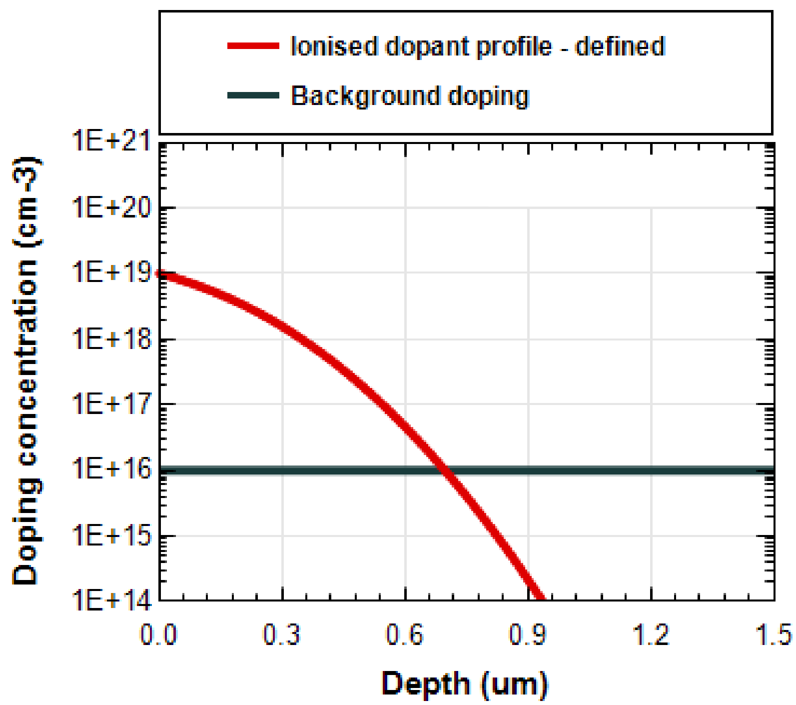

Figure 3:- Doping concentration for silicon with boron doped background versus the junction depth.

Figure 2 and figure 3 shows the doping concentration for boron doped background silicon and phosphorus doped background.Both figures show the same doping concentration change .

Over the range 0.0um-0.91um the ionized doping concentration decreases for both types of silicon .Nevertheless the background doping concentration is constant and each position at the junction.

The sheet resistance evaluating for both types of silicon is show on the simulations results.
The silicon with boron doped background has a sheet resistant equivalent to 235.58 Ω/sq and the junction depth is 0.70 μm.

The silicon with phosphorus doped background has a sheet resistance equivalent to 26.09Ω/sq.

The results show that the silicon with boron doped background has larger sheet resistance than the silicon with phosphorus doped background.That means the sheet resistance is greater when the background and and the dopandprofil are of opposite types.

Conclusion:-

The purpose of this study is to evaluate the sheet resistance of the silicon doped boron background and the silicon doped phosphorus background ; compare their values.The results show that the silicon The results show with boron doped background has larger sheet resistance than the silicon with phosphorus doped background.That means the sheet resistance is greater when the background and and the dopandprofil are of opposite types.And the doping background concentration is consider constant in this work.This can be enlarge by using perovski solar cell.

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