הפקולטה למדעי הנדסה אוניברסיטת בן גוריון בנגב

היחידה להנדסת אלקטרואופטיקה טל: 08-6461448 פקס: 08-647949

סמינר מחלקתי

n-Si based solar cells fabricated using B ion implantation

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The recent appearance on the market of relatively cheap n-type single crystalline Si of high quality has created new opportunities in terrestrial solar cell production. The advantage of n-Si over p-Si as a starting material for solar cell fabrication is its higher lifetime of minority carriers (holes in n-Si). To benefit from this advantage of n-Si, key issues such as p-type emitter and high-low barrier formation, surface passivation as well as bulk lifetime retaining, should be studied and developed. Combined thermal diffusion-ion implantation technology was used for the study as a promising fabrication procedure (30 keV B ion implantation, thermal diffusion of P for the n+ layer doping). In order to optimize the process, electro active implanted B atoms distributions were experimentally studied after different annealing temperatures and conditions: with simultaneously grown silicon oxide layer, with preliminary CVD deposited SiNx layers, and after back-to-back heating. The use of SiNx layer was suggested as a cap cover preventing out-diffusion of implanted B ions. As a result, lower dose of B ions can be used causing less defects, and shorter process.

Two main solar cell design concepts for n-Si were under consideration: front- or back-junction solar cells. Simulation using the PC1D program allows the formulation of the main requirements for fabrication technology and design of front or back junction cells. Back junction cells were chosen as a preferable design. Minority carrier lifetime in Si wafers during solar cell processing was monitored using the Quasi-Steady-State Photoconductance and the Transient Photoconductance Decay methods. Implanted and diffused layers recombination parameters were also determined. Impurity gettering by P doped layer was found to have a compensating effect on the lifetime degradation

due to thermal treatment. The ~18 % efficiency achieved was measured for cell samples with n+-n-p+ structure.

הסמינר יתקיים ביום ג' 18/04/17 בשעה 12:00 בניין 51 אולם 015