Investigation of an Additional Oxidation in-situ Step During Boron Diffusion Processes on P^+ Emitter Properties

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ABSTRACT

Diffusion of boron in n-type silicon from preform source when using one step high temperature as drive-in temperature during the diffusion process was found to produce p+ emitter with relatively high surface concentration up to 1020 atoms /cm3, leading to high surface recombination, and resulting, therefore, in the formation of an undesirable boron rich layer (BRL) whichis found to be responsible for the degradation of the bulk lifetime. One way to reduce the emitter boron surface concentration and to avoid the formation of the BRL is to add an additional step during the diffusion process which is the oxidation in-situ. The main purpose of the present work is to investigate the effect of a combination betweenan oxidation at 800°C for 30 min in oxygen ambient following a drive-in step at 910°C for 20 min in nitrogen ambient and a variable boron dose on the properties of theproduced emitters. The boron dose was adjusted by varying the temperature ramp-up time from 51 min to 102 min. It was found that the boron surface concentration is reduced significantly from 1.17x1020 to 2.31x1019 atoms/cm3 as measured by electrochemical capacitance voltage technique leading to an increase in sheet resistance from 45 to 65 Ω/sq as measured by four point probe after adding an oxidation in-situ step. The use ofthe free on line simulator EDNA 2 for plotting the variation of emitter dark saturation current density J0e asa function of effective surface velocity SRVeff shows thatadding a second step during diffusion process enhance considerably the electrical properties of the emitter.

Keywords: preform source, boron diffusion, boron rich layer, depletion zone, EDNA 2, simulation, n-type silicon, solar cells

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