www.elsevier.com/locate/jcrysgro

Effect of Sn doping on improvement of minority carrier lifetime of Fe contaminated p-type multi-crystalline Si ingot

Jifei Sun, Qiuxiang He, Boyuan Ban, Xiaolong Bai, Jingwei Li, Jian. Chen

PII: S0022-0248(16)30691-1
DOI: http://dx.doi.org/10.1016/j.jcrysgro.2016.11.025
Reference: CRYS23752

To appear in: *Journal of Crystal Growth*

Received date: 10 August 2016
Revised date: 1 November 2016
Accepted date: 1 November 2016

Cite this article as: Jifei Sun, Qiuxiang He, Boyuan Ban, Xiaolong Bai, Jingwe Li and Jian. Chen, Effect of Sn doping on improvement of minority carrie lifetime of Fe contaminated p-type multi-crystalline Si ingot, *Journal of Crysta Growth,* http://dx.doi.org/10.1016/j.jcrysgro.2016.11.025

Effect of Sn doping on improvement of minority carrier lifetime of Fe contaminated p-type multi-crystalline Si ingot

Jifei Sun [1,2], Qiuxiang He[1], Boyuan Ban[1] , Xiaolong Bai[1], Jingwei Li[1]， and Jian Chen[1,*)]

[1]Key Laboratory of Novel Thin Film Solar Cells, Institute of Applied Technology, Hefei Institutes of Physical Science, Chinese Academy of Sciences, Hefei, 230031, P. R. China

[2]University of Science and Technology of China, Hefei 230026, P. R. China

[*]Corresponding author. Tel.:+86-551-65592171. jchen@rntek.cas.cn.

Abstract

The influence of Sn doping on improvement of minority carrier lifetime (MCL) of Fe contaminated directionally solidified p-type multi-crystalline Si ingots is studied. The macrostructure and resistivity distribution of the Si ingots indicate that no significant difference exists with and without Sn doping. The average MCL increase by 26.2%, 31.8%, 8.1% with 20ppmw, 40ppmw, 60ppmw Sn doping, respectively. The MCL was improved evidently due to the reduction of formation of interstitial Fe, FeB. The doping of Sn promotes formation of vacancies, which also contributes to passivation of interstitial Fe and FeB. A calculation of constitutional supercooling is carried out, which shows that Fe have great influence on the solidification interface stability, and Sn have little influence on the interface stability.

Key words: A1. Minority carrier lifetime, A1. Doping, A1. Impurities, A2. Directional solidification, B2 Multi-crystalline Si

1. Introduction

It is common sense that metal impurities dramatically reduce MCL, and hence the solar cells efficiency. Especially Fe, one of the lifetime-killing contaminants, which distributes widely in equipment, air, dust and raw materials in industrial production. It generally occupies interstitial sites in the Si lattice and has a fast diffusion rate. There are many Fe related-defects in silicon [1, 2]. In p-type Si, positively charged Fe ions tend to form FeB complexes with negatively charged boron ions at room temperature. The FeB complexes could be a strong recombination center that will reduce MCL and