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Carrier mobility reduction and model in n-type compensated silicon

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Key words: *carrier mobility, simulation model, n-type compensated silicon, Cz crystal growth*

Abstract: Research on electrical properties of the compensated silicon is very crucial for understanding the doping layer and compensated substrates of solar cells. Regarding the fact that there are still inadequate experimental data of carrier mobility on the n-type compensated silicon, hence in this paper, both majority electron and minority hole mobilities measured on the n-type compensated solar-grade silicon substrates are presented. Prediction models of carrier mobility are essential for material characterization and device (e.g. solar cells) simulation. However, as prediction models of carrier mobility are commonly established based on the uncompensated silicon, large deviations of carrier mobility have been observed on the compensated silicon. In this work, the standard Klaassen's model and optimized model for the compensated silicon by Schindler et al. are reviewed and compared to measured carrier mobilities. Moreover, the factors that lead to deviations of Klaassen's model on the n-type compensated silicon are critically discussed, and then we propose an optimized model for prediction of carrier mobility in the compensated silicon. This model can also be extended to both majority and minority carrier mobilities in p- and n-type compensated silicon and fits well with previous published data as well as carrier mobility data presented here. In addition, evolutions of majority electron and minority hole mobilities as crystal grows are also simulated for n-type compensated Czochralski silicon which agrees well with our measured results.

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