

Numerical analysis of bifacial solar cell using PC1D software

Abstract

Computer-based simulations play a critical role in the design, development, and functionality of solar cells. Device modeling techniques substantially reduce the time and costs through optimization of process steps, choice of materials, and wafers. In this study, bifacial solar cell devices have been modeled using actual physical device configurations. In this study, a detailed description of npp⁺ bifacial solar cell based on PC1D simulations has been carried out. The structure of npp⁺ was selected for all simulations due to excellent results obtained from this type of solar cell. The npp+ configuration is also the simplest, most widely used solar cell, is simple to fabricate, and can be adapted for all types of solar cells. The efficiencies obtained from this design were 16.42 % and 14.18 % for front and back surfaces respectively. These simulations suggest that rear surface efficiency is a sensitive function of minority carrier lifetime, BSF doping level, and surface recombination velocity. Simulations results adequately explained performance of Al BSF bifacial solar cells fabricated in the laboratory.

Keywords; A1 BSF; Bifacial solar cell; PC1D simulation; Silicon solar cells