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Capacitance Measurements on Potential Induced Degradation of Polycrystalline Silicon Solar Cells

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Polycrystalline silicon (poly-Si) solar cells, in the absence of effective and substantive electrical protection, are very susceptible to point defect formation. Naturally this would occur if the cell were reversed bias by its adjacent string cells when it is partially shaded, say.
For this study we have induced degradation on a single partially shaded poly-Si cell through reverse biasing the cell under illumination of 100 mW/cm2. Degradation of the cell was confirmed through current-voltage (I-V) measurements before and after degradation. Before the induced degradation, capacitance-voltage (C-V) measurements were used to establish the doping density and build-in voltage at the cell junction, both in the dark and under illumination. The depletion width or space charge region of the junction and the average diffusion length were also estimated. After the induced degradation, these parameters were measured again under the same conditions.
Apart from the observed morphological damage to the micro morph of the polycrystalline structure, a significant reduction in the build-in voltage was observed. In addition, the decrease in the diffusion length indicated that new interstates were formed due to junction breakdown, allowing the electrons to recombine in a comparatively shorter distance from where it is generated towards the depletion region edge.
The final paper will give a detailed account of the observed induced degradation, its effect on doping density, build-in voltage and the total thickness of the cell that is contributing to the photo-generated current.

Keywords: Polycrystalline Silicon Solar Cells, Capacitance-Voltage Measurements, Performance Degradation, Build-in Voltage, Doping Density, Depletion Width

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