

Area 7: Performance and Reliability of PV Modules

ESTIMATING THE PERFORMANCE OF PID-INFLUENCED PV MODULES FROM QUANTITATIVE ELECTROLUMINESCENCE MEASUREMENTS

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In a collaborative effort involving SERIS, NREL, and Trina Solar to study PV modules potential-induced degradation (PID), testing fields have been set up under three different climates: tropical, subtropical, and sub-arid climates in Singapore, Changzhou (China) and Golden (CO, USA) respectively. Each testing site has six groups of modules developed by Trina Solar with different grades of PID resistance ranging from weak to strong. Among all the locations, Singapore presents the most severe conditions for module PID. At SERIS, the impact of potential-induced degradation (PID) on PV module performance is quantitatively analyzed using spatially resolved electroluminescence (EL) imaging. Indoor EL images and I-V characteristics were measured every month. In this work, the EL method is applied as metrological tool to predict the module power losses due to PID. Firstly, all images taken (Figure 1) were corrected for camera and perspective distortions (Figure 2). After correction, the intensity distribution of each cell, relative to its initial values is analyzed. To translate the relative EL intensity to cell performance, a simplified equivalent circuit is used to calculate the relative changes on the effective I-V curve (Figure 3). The metrological performance of this method is quantified through comparison with I-V curves, obtained from indoor flash tests (Figure 4).

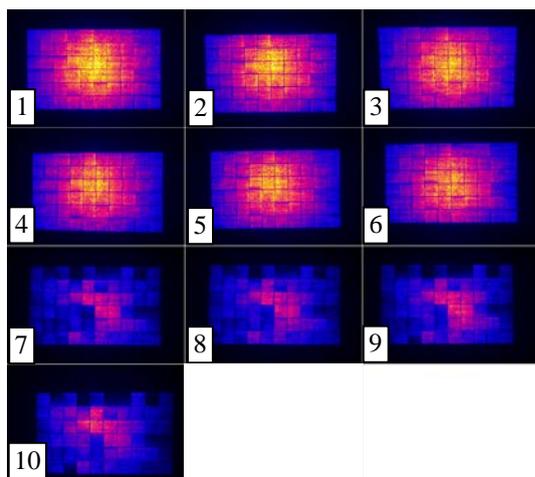


Figure 1: Raw EL images of a PID-stressed module, imaged between August 2016 (index 1) and May 2017 (index 10)

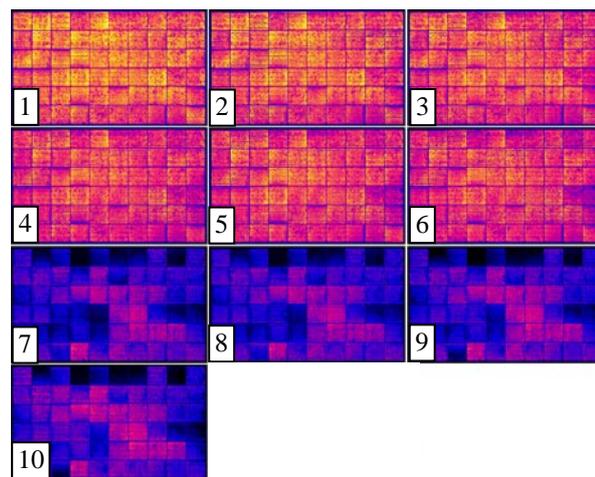


Figure 2: EL images after camera and perspective correction for raw images in Figure 1

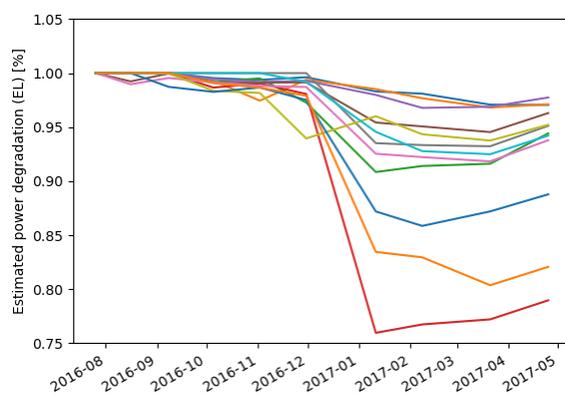


Figure 3: Estimated power degradation for 12 PID-prone modules, obtained from the relative change of cell intensities in the corrected EL images (as shown in Figure 2)

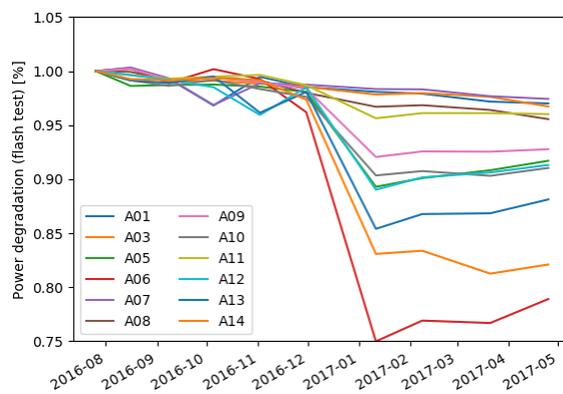


Figure 4: Power degradation of the same modules (as shown in Figure 3), obtained from illuminated I-V characteristics