Versatile Implied Open-Circuit Voltage Imaging Method and its Application in Monolithic Tandem Solar Cells

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Abstract

As the efficiency of perovskite silicon tandem solar cells is increasing, the upscaling for industrial production is coming into focus. Spatially resolved, quantitative, fast, and reliable contactless measurement techniques are demanded for quality assurance and to pinpoint the cause of performance losses in perovskite silicon tandem solar cells. In this publication we present a measurement method based on spectrally integrated photoluminescence (PL) imaging to extract subcell-selective implied open-circuit (i V oc) images from monolithic perovskite silicon tandem solar cells. We validate the approach using spectrally resolved absolute PL measurements based on an integrating sphere for the perovskite top cell and PL-calibrated carrier lifetime images for the silicon bottom cell. Additionally, V oc measurements of solar cells with low contact losses are used to validate the new measurement technique. We find a good agreement of the i V oc images with the validating measurements with a maximum deviation of well below 1 % compared to the validation measurements.

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