

Photoimpedance Spectroscopy Analysis of Planar and Nano-Textured Thin-Film Silicon Solar Cells

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Abstract : In impedance spectroscopy (IS) the response of a photo-active device is analysed as a function of ac bias. It is widely applied in a broad class of material systems and devices. It gives access to fundamental mechanisms of operation of solar cells. We have implemented a method of IS where we modulate the light instead of the bias. This scheme allows us to analyze not only carrier dynamics but also impedance of device locally. Here, using this scheme, we have measured the frequency-dependent photocurrent response of the thin-film planar and nano-textured Si solar cells using this method. Photocurrent response is measured in range of 50 Hz to 50 kHz. Bode and Nyquist plots are used to determine characteristic lifetime of both the cells. Interestingly, the carrier lifetime of both planar and nano-textured solar cells depend on back and front contact positions. This is due to either heterogeneity of device or contacts are not optimized. The estimated average lifetime is found to be shorter for the nano-textured cell, which could be due to the influence of the textured interface on the carrier relaxation dynamics.

Keywords : carrier lifetime, impedance, nano-textured, photocurrent

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