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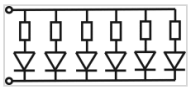
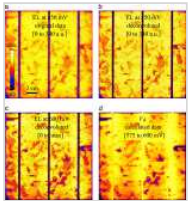
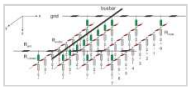
Figures and tables







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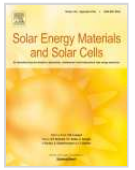

Description of the local series resistance of real solar cells by separate horizontal and vertical components

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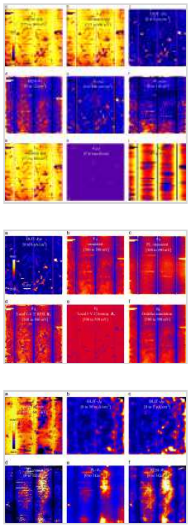
Highlights

- The series resistance of a solar cell is described by two separate components.
- They describe local resistances for horizontal and vertical current flow.
- These resistances hold both for the dark and the illuminated case.
- A strategy is proposed to fit these resistances to measured EL and DLIT images.
- A finite element model with these resistances describes the solar cell well.

Abstract



All previous concepts for describing the effective local series resistance of really existing solar cells, as it can be measured e.g. by luminescence imaging, try to describe it by a single local number. In solar cells showing an inhomogeneous saturation current density, this results in different series resistance images for the dark and illuminated case. The reason is the distributed character of the series resistance and the different diode current profiles under these different conditions. In this work the well-known finite element concept is used for describing a solar cell, which contains separate resistors carrying horizontal and vertical currents. A strategy is proposed how to fit these resistors to results of electroluminescence and lock-in thermography images of a real solar cell, leading to separate images of the local horizontal grid resistance, which may also show broken gridlines, and the local vertical 'lumped emitter contact resistance'. The latter lumps all resistive inhomogeneities of the cell, caused by a possibly inhomogeneous contact-, emitter-, grid-, bulk-, and back contact resistance. It will be shown that this description of the local series resistance reasonably describes both the dark and illuminated case, even in inhomogeneous multicrystalline silicon solar cells.

Keywords

Lock-in thermography; Electroluminescence imaging; Photoluminescence imaging; Device simulation; Local series resistance

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