



Max-Planck-Innovation

## Technology Offer

### Electroluminescence Imaging Evaluation: Software EL-Fit

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### Background and Technology

This software is based on the paper "Quantitative evaluation of electroluminescence images of solar cells" by O. Breitenstein et al.<sup>1)</sup>. It allows to load a number of electroluminescence (EL) images to different biases, which have to be given as ASCII tables. By using an iterative procedure, from two of the EL images the software allows to calculate an image of the local area-related series resistance  $R_s$  (in units of  $\Omega\text{cm}^2$ ) and of the local saturation current density of the diffusion current density  $J_0$  (in units of  $\text{A}/\text{cm}^2$ ). This procedure is based on the Fuyuki approximation saying that the luminescence intensity is proportional and the dark saturation current density is inversely proportional to an "effective diffusion length" in the base, which also takes into account a finite base thickness and backside recombination. Due to its iterative nature, the procedure works correctly even if both EL measurements are made at a relatively high voltage resp. current, which enables low acquisition times. In addition, also images of the effective diffusion length and of the effective bulk lifetime are generated. The generally unknown proportionality factor "f" may be fitted so that either the average series resistance or the average saturation current density matches the value taken from the dark I-V characteristic of the whole cell. Moreover, from one selected EL image (taken at a possibly low voltage) an "ohmic shunt" image of the ohmic parallel conductance G (given in units of  $\text{S}/\text{cm}^2$ ) can be derived. This procedure is based on the approximation of a homogeneous cell, hence here the series resistance and also the bulk lifetime are assumed to be homogeneous. It can only be applied to sufficiently strong ohmic shunts.

Single User license for EL-Fit (version 8.0) without source code (industry, no additional users)  
Total Price: EUR 500,--

The above price includes:

1. The license fee for a non-exclusive right to use and display the software program.
2. The software and manuals in PDF and PostScript format. You have the choice whether this should be sent by e-mail or by regular mail (in the latter-case a CD-ROM is delivered).

### Literature

Quantitative evaluation of electroluminescence images of solar cells  
O. Breitenstein, A. Khanna, Y. Augarten, J. Bauer, J.-M. Wagner, K. Iwig  
physica status solidi (RRL) - Rapid Research Letters, Volume 4, Issue 1-2, pages 7–9, February 2010