



Si Material

imec

Cell Modeling infrastructure and software

Location of the infrastructure : Leuven, Belgium

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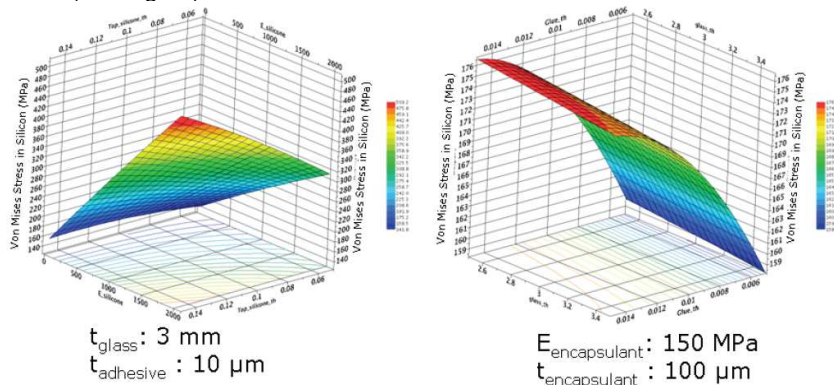
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- Objectives :**
- Electrical and optical characterization of wafers
 - FE modeling of thermo-mechanical effects and stresses

Main features : The electrical and optical characterization techniques comprise Carrier Density imaging (CDI), Photo- Luminescence Imaging (PL), Lock-In-Thermography (LIT), low-injection QSSPC, spectral response and reflectivity measurements. This is complemented by a number of nano-characterization tools to determine local carrier concentration (SSRM-scanning spreading resistance measurements), local impurity concentration (Time-Of-Flight-SIMS) near defects and grain boundaries and local opto-electronic properties (EBIC, Conductive-AFM). The characterization facilities offered are embedded in a large research infrastructure for industrial and clean-room based high efficiency solar cell processing.

In order to integrate ultrathin wafers and cells into solar modules, it is not sufficient to consider just electrical and optical performance. With decreasing silicon thickness, thermo-mechanical effects become increasingly important during the processing sequence itself (thin wafers are more prone to warping, breakage, thermally induced strain). Moreover, module lifetime is critically dependant on thermo-mechanically induced stresses. We can offer 2D and 3D finite element modeling where stresses, strains and deformations can be calculated, extracted and represented in a module. A simplified 2D layer model already illustrates the possibilities of modeling for a simple system consisting of an ultrathin Si sample embedded on a glass module by means of Silicone (see Figure).



More generally, such models effectively predict the influence of the different layers in the module and therefore learn how they can be tuned to minimize stresses in the build-up. However, the construction of 3D-models is necessary to predict also local effects, especially in the more critical areas of the module as corners and such.

Limitations or constraints : The infrastructure is used predominantly for internal research and co-operation projects with industry and other research institutes. Access to the characterization infrastructure by international users is provided for limited period (e.g., 3 months/year) for non-commercial purposes, i.e., only for scientific R&D.

Typical services or results : Access to use the simulation platforms is offered for the simulation of advanced high-efficiency Si solar cell structures and the detailed analysis of local effects in multicrystalline Si materials and solar cells.

Examples of research projects : Electrical and optical characterization and simulation of cells and Si material.