Title : Optical and electrical local properties of silicon solar cells from cast-mono technology

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The photo- or electro-luminescence are versatile tools to investigate semiconductors material or devices such as solar cells and many developments have occurred during the last decade. We show how to use advanced luminescence techniques to make correlations between macro and microscopic transport properties.

One the one hand, hyperspectral luminescence images allows accessing to local material properties and we underline the need of a careful data treatment. On the other hand, time resolved luminescence images give access to local and global transport properties. These methods are applicable for example to thin film materials and devices.

We will focus on optical and electrical behavior of the dislocations in cast-mono silicon cells, recognized by their well-known peaks D1 (1550nm) to D4 (1225nm). We have made a joint analysis of spectral and time-resolved luminescence images, which helps to give a detailed picture of the origin of cells' opto-electronic parameters changes. Using a spatial correlation of these results with chemical data such as iron concentration or physical data such as dislocation density, we have been able to attribute, for example, the recombination currents of a two-diode model or the series and shunt resistances to a specific cause. In addition, the spectral dependence of the luminescence of the bulk and of the dislocations themselves, fitted as a whole, has shown the influence of the phononic mechanisms in the absorption profile. This might suggest that the dislocations are not only recombination centers or mobility reducers but less efficient absorption zones.

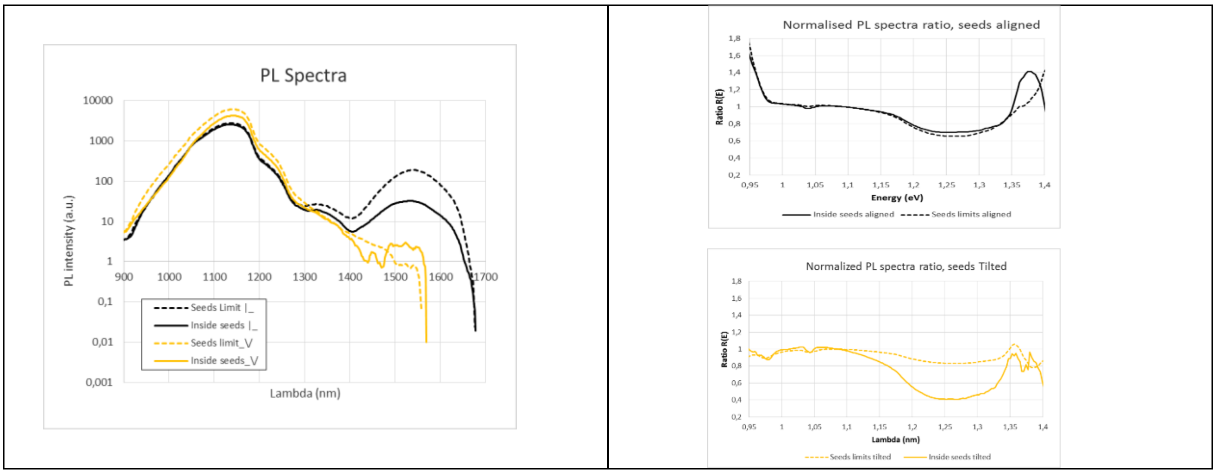

Figure a – PL spectra and relative absorbance of cast-mono silicon wafers with seeds aligned or tilted. This shows the quasi-extinction of the D1-D2 luminescence lines of dislocation with tilted seeds, and the influence of the change in absorption properties of the dislocations.

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