

## **STUDY OF CIGS MICROCELLS PREPARED BY MECHANICAL SCRIBING OF HIGH EFFICIENCY DEVICES**

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CIGS thin film solar cells have recently achieved a record efficiency of 22.6% [1], paving the way for accelerating the development of this technology at the industrial level. In parallel, it has been recently demonstrated that CIGS devices are able to work efficiently at the microscale level, opening a new approach for concentrated PV applications : thin film microcell concentrators [2-5]. First experimental proofs of concepts have been published [3-5]. However, a successful route for demonstrating the potential of CIGS microcells, starting from record efficiency devices has not been explored yet.

In this work we have explored a simple mechanical scribing approach for creating microcells from a completely processed devices. Mechanical scribing is used for long time to isolate CIGS stripes, on the several mm scale on Mo substrate for monolithic integration, in the P1-P2-P3 sequence. The success of this approach is due to the fact that the cutting edges are made by a cleaving process. In this work we have made a systematic study of the effect of reducing the distance between scribing line, and found conditions where only a few tens of microns width CIGS stripes were remaining on the Mo substrate. Combining with another scribing perpendicularly allowed the formation of microscale solar cells, retaining the original high efficiency stacking.

Figure 1 shows an example of an array of microcells created by this way, with areas down to the  $10^{-5}$  cm<sup>2</sup> level. We observe that the open circuit voltage is maintained and also the short circuit photocurrents (variations are due to shading effects of the contacting probe). Thus the microcells retain the characteristics of reference cells. Statistical analysis of the photovoltaic parameters as a function of the cell areas have been carried out. This demonstrates that mechanical scribing can be used for creating microcells. The main problem at this stage was the high series resistance arising from non optimized contacts. First experiments under concentration have been carried out successfully but the contact resistance did not allow to go higher than 30 suns. Experiments are in progress with improved contacts and high efficiency devices.

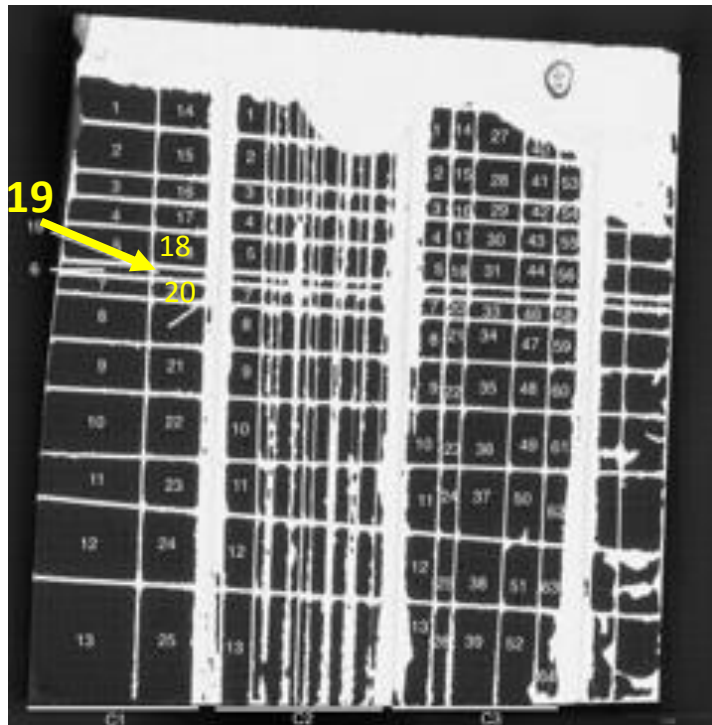
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Microcell Reference	Microcell Size (cm <sup>2</sup> )
LR004_1_18	5,931E-03
LR004_2_19	1,029E-04
LR004_2_20	3,863E-04
LR005_2_25	6,213E-02
LR005_2_35	2,103E-03

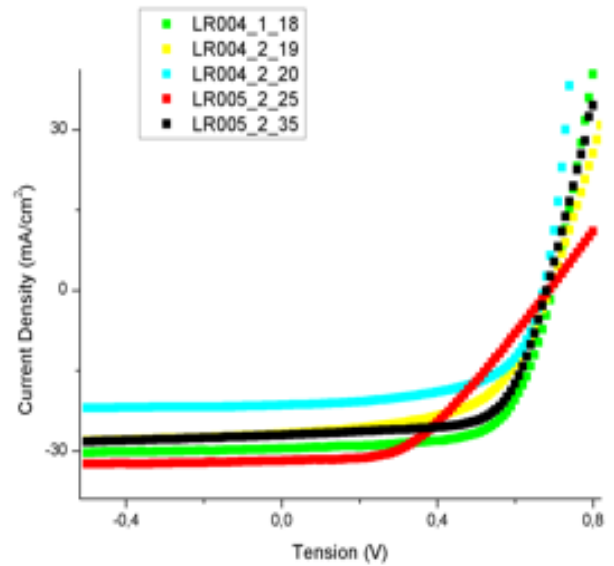


Figure 1: Microcell array created by mechanical scribing (left). Size of selected cells and corresponding IV curves under illumination (AM1.5).