Laser Processing optimization for 2D materials-perovskite solar modules

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Industrial applications for two-dimensional (2D) material-perovskite solar devices require optimized fabrication steps devoted to scale-up efficient lab-scale devices to large area modules. In this work, with the aim to get an efficient series interconnection between module constituting sub-cells, we employed a 10 ps laser (λ=355 nm) for all the ablation processes (namely P1, P2, P3), by carrying out a fully optimized device layout [1,2]. If, on one hand, the quality of P2 process has a strong impact on the module serial resistance, on the other hand a not fully optimized P3 process can lead to low parallel resistance value. In the present work, we show how the module performance can be improved by the optimizing P2 and P3 processes. The parameters used for each laser ablation step were set to obtain an efficient and fast process by retaining high process repeatability. As a matter of fact, laser fluence and process speed need to be optimized taking into account the presence of 2D materials and their depositions techniques, preventing the incomplete removal of the layers or the laser-induced active area degradation.

REFERENCES

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[2] Alessandro Lorenzo Palma, Fabio Matteocci, Antonio Agresti, Sara Pescetelli, Emanuele Calabrò, Luigi Vesce,Silke Christiansen, Michael Schmidt, and Aldo Di Carlo, IEEE Journal of Photovoltaics, 6 (2017) 1674-1680

FIGURES

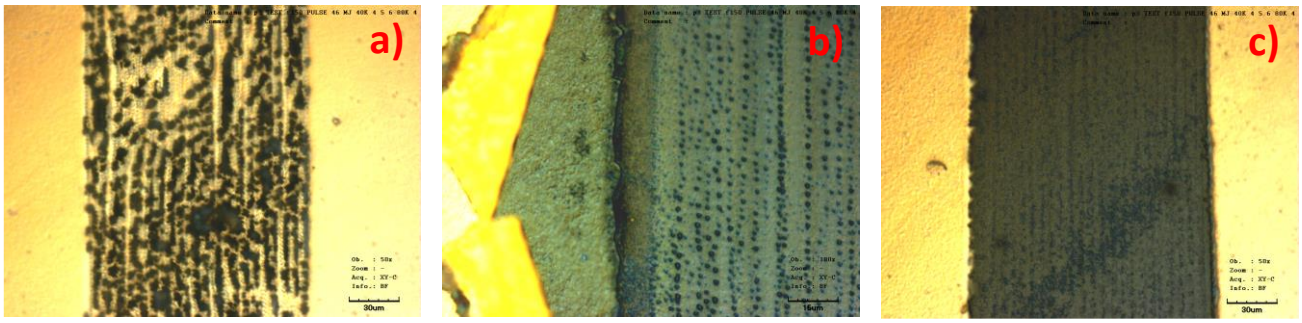

Figure 1: a) P3 scribe with electrical bridges due to a incomplete gold removal; b) gold delamination induced by using a very high fluence used during P3 process; c) optimized P3 scribe without gold residual particles in the scribed area and no delamination on the edge

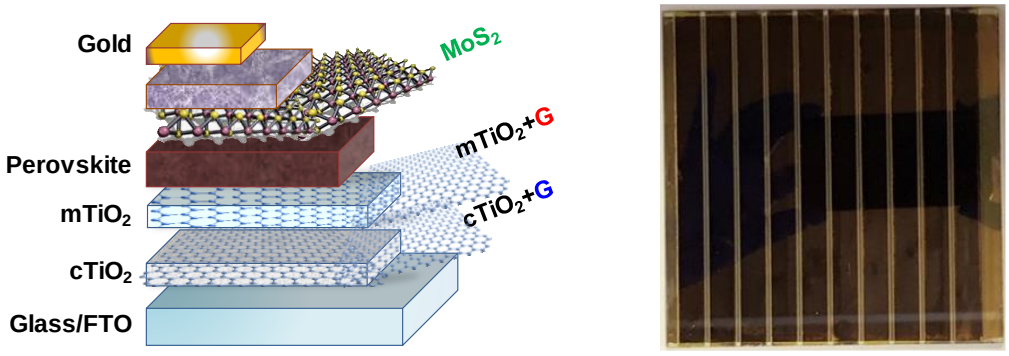

Figure 2: Cell structure and final module made realized by laser pattering of graphene, perovskite and 2D materials layers.