doi:10.1017/S1431927611004168
Microsc. Microanal. 17 (Suppl 2), 2011

Efficient Target Preparation by Combined Pulsed Laser Ablation and FIB Milling

H. Stegmann[*], H. Dömer[*], R. Rosenkranz[**], and E. Zschech[**]

[*]Carl Zeiss NTS GmbH, Carl-Zeiss-Str. 56, 73447 Oberkochen, Germany
[**]Fraunhofer Institute for Non-Destructive Testing, Dresden branch, Maria-Reiche-Str. 2, 01109 Dresden, Germany

Today, sample preparation for electron microscopy more often than ever requires the removal of large amounts of material to access deeply buried sample structures. Until now, such target preparation has been achieved using demanding and slow techniques, such as metallographic cross-sectioning and ion polishing, or focused ion beam (FIB) milling. A new tool that combines pulsed laser ablation and FIB milling now allows precise target preparation of deeply buried features in a much more efficient way.

In a technology study, a pulsed laser was attached to a Carl Zeiss CrossBeam® FIB/SEM system. Laser ablation at the region of interest with high positioning accuracy [1] is performed within minutes, followed by FIB preparation and SEM analysis in the same instrument. The feasibility of ablating different materials in 3D integrated devices with such a laser resulting in a surface roughness of around 5 μm has recently been demonstrated [2]. The heat affected zone was shown to be limited to the order of the surface roughness [3].

As an example, Fig. 1 shows a 2.5×1.0×0.8 mm^3 box cut with the laser in 2 min through the complete functional stack of a flexible thin film solar cell module down to a contact structure. A FIB cut was made at one of the laser box side walls in order to expose the interfaces of an Ag-Epoxy contact for subsequent SEM imaging.

Precisely targeted laser ablation is also a promising approach for trimming samples to more complex geometries. The use of this tool for the preparation of micropillars from sedimentary rock samples is shown in Figs. 2 and 3. Such pillars can be shaped further and cut free by the FIB and then be used, e.g., for X-ray nano-CT.

This contribution will feature examples from different application areas, such as contact technologies for 3D integration, photovoltaics, packages, geological and biomedical structures.

References

[1] M. Petzold et al., *Proc. 60th Electronic Compon. and Technol. Conf.* (ECTC) (2010) 1296.
[2] S. Martens et al., *ASME J. Electronic Packaging* 131(3) (2009) 1.
[3] S. Martens et al., *Proc. 11th Int. EuroSimE Conf.* (2010) 1.

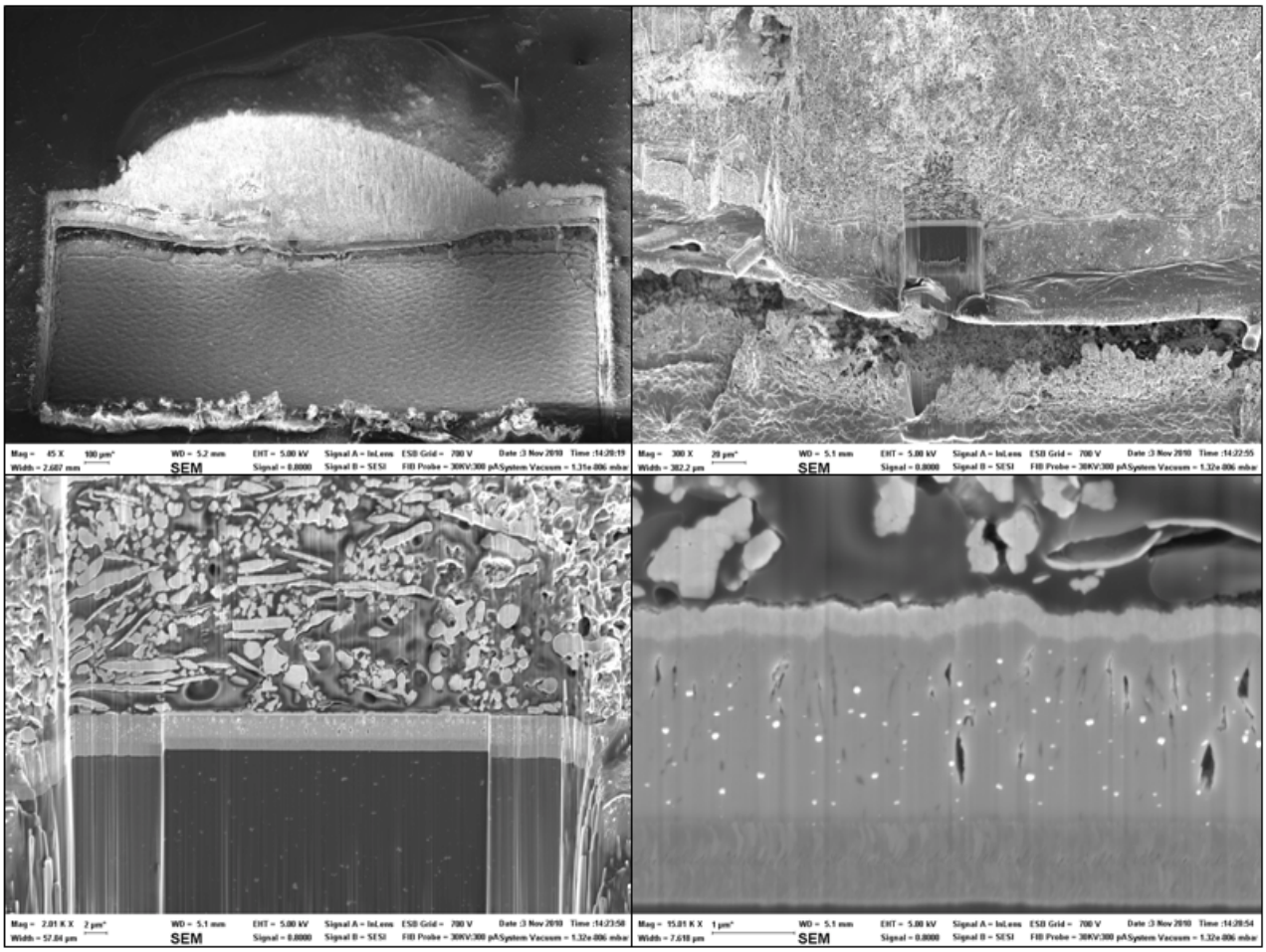

FIG. 1. A 2.5×1.0×0.8 mm^3 box cut with the laser into a flexible thin film solar cell module (top left). A FIB cross-section was cut into the laser cross-section (top right and bottom left) for SEM imaging of the Ag-Epoxy contact area (bottom right).

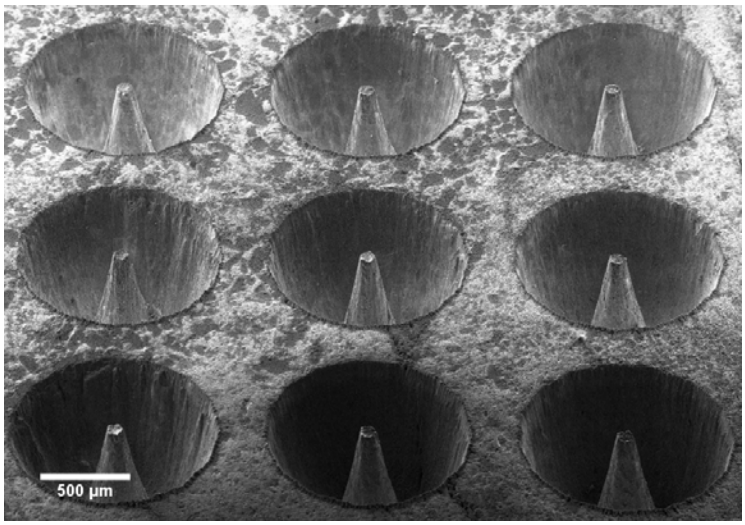

FIG. 2. Micropillar array cut with the laser into a shale rock sample.

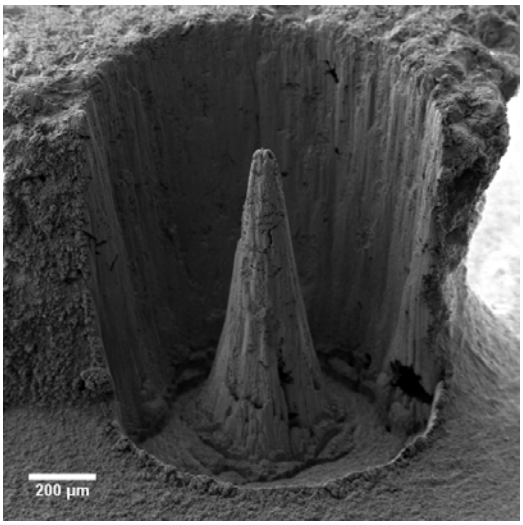

FIG. 3. 1 mm high pillar laser cut into a sandstone sample.

https://doi.org/10.1017/S1431927611004168 Published online by Cambridge University Press