Degradation of surface passivation at the surroundings of laser processed regions in c-Si solar cells studied by micro-photoluminescence

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ABSTRACT
Laser firing processes have emerged as a technologically feasible approach to fabricate local point contacts or local doped regions in advanced high-efficiency crystalline-silicon (c-Si) solar cell structures. Since laser-assisted processes are characterized by a high-temperature local step (i.e. rapid melting and solidification), it is a key aspect for their optimization to study the specific impact of these local thermal cycles on the surface and passivation properties at the laser-processed region (LPR) vicinity. In this work, we use micro-photoluminescence (PL) spectroscopy to carry out a spatially-resolved characterization of LPR applied in passivated c-Si substrates. By means of the methodology presented here, it has been possible to extract a close insight about the impact of laser-assisted processes on surface passivation performance, and hence, to obtain valuable information to further optimize LPRs.

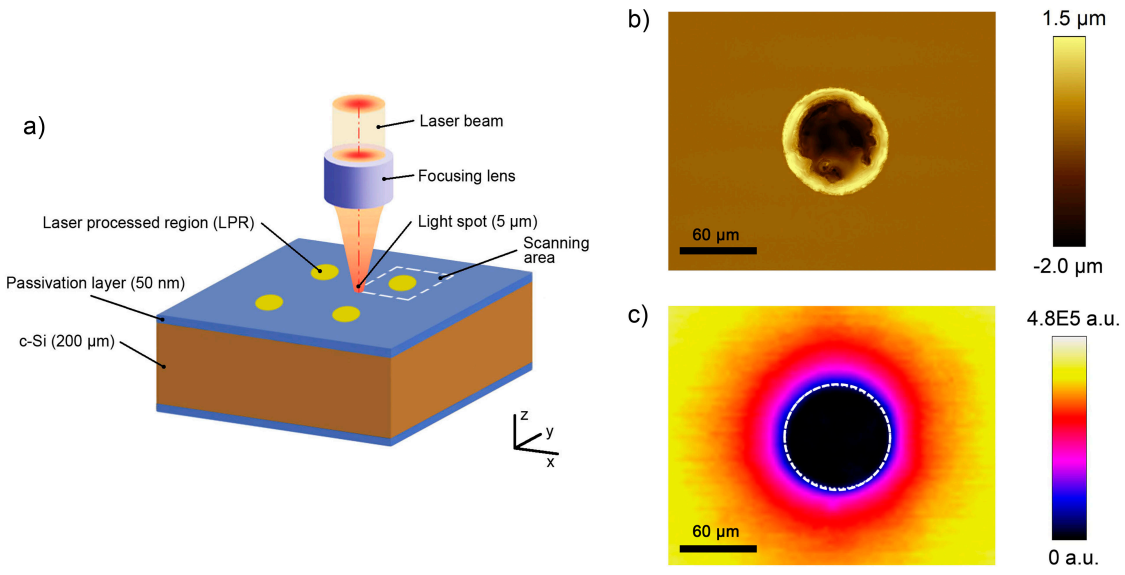

Figure 1: Scheme of the experimental setup (a) used for the micro-PL measurements. Topography map (b) and micro-PL map (c) of a single laser-processed region (LPR) performed at 1.44 W in an Al_2O_3-passivated c-Si wafer. In the PL map, the physical dimensions of the LPR are indicated by the white dashed circle. The decrease in PL signal observed at the LPR vicinity is linked to a local decrease of the passivation performance.