Photoconductivity-based characterization of organohalide-perovskites with coplanar ohmic contacts

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The localized states inside the band-gap of a semiconductor are produced by the disorder and the coordination defects in the atomic structure. They act as recombination centers for the free carriers, negatively affecting its photoconductivity. Therefore, the excess-carrier properties of a photo-excited semiconductor are important indicators of its quality for applications in optoelectronic devices such as solar cells. In the last decades, several techniques based on the measurement of the secondary photoconductivity have been proposed to determine fundamental transport parameters of a semiconductor, such as the diffusion length of the photocarriers, the density of localized states, and the ratio between the capture coefficients of the localized states and the mobility of free carriers.

Organohalide-perovskite solar cells have emerged as a leading next-generation photovoltaic technology. However, despite surging efficiencies, many questions remain unanswered regarding the mechanisms of operation. The characterization of its layers may help to clarify this issue. In this work, we apply different photoconductivity-based techniques to extract fundamental transport parameters of the triple-cation perovskite, used as the absorber layer in state-of-the-art solar cells [1]. Analysis of the results obtained with the steady-state photocurrent, the steady-state photocarrier grating, and the modulated photocurrent experiments will be presented.

References

[1] Michael Saliba *et al.*, "Cesium-containing triple cation perovskite solar cells: improved stability, reproducibility and high efficiency," *Energy Environ. Sci.*, vol. 9, no. 6, pp. 1989–1997, Jun. 2016.