Berkeley Photonics

Request for Technical Assistance

In-situ ultrafast photovoltaic spectrometer (*in-situ* UPVS)

Overview

One of the major challenges in the photovoltaic characterization field is to have an ultrafast photocurrent instrument with couple picoseconds (ps) (couple trillionth seconds) time resolution to *in-situ* test solar cells, because these dynamics study is one of the most important information to further improve the device efficiency and stability.

We aim to develop a sub-5 picosecond ultrafast photovoltaic spectrometer to characterize solar cells *in-situ*. We have developed an *in-situ* UPVS by integrating a high-speed transmission line waveguide with a photoconductive switch, leading to a less than 50 ps time resolution. This spectrometer is two orders magnitude faster than traditional time-of-flight photocurrent method. We demonstrated the ultrafast photocurrent measurements from > 20% efficiency solution-processed perovskite solar cells. This unique *in-situ* UPVS has the following experimental specifications: 1) the temperature is from 5 to 500 Kelvin; 2) the wavelength response range is from 400 to 1100 nm; 3) the ultrafast laser source can illuminate either from top contact or the bottom contact side; 4) the voltage bias is from – 200 to + 200 volts.

Industry assistance

Since we demonstrated the ultrafast photocurrent measurements in thin film perovskite solar cells, from the industry side, we would like to widely apply the *in-situ* UPVS to other PV technologies of the American-Made Network in the following categories: single junction and multijunction solar cells; thin film, amorphous, and crystalline silicon solar cells; emerging PV such as OPV, quantum dot, CZTS, perovskite, dye-sensitized solar cells. These companies can be major PV companies such as First solar, Tesla/Panasonic, Solaria, SunPower, MiaSolé, Lumos Solar, CertainTeed Solar, Auxin Solar, SunSpark, *etc*.

National Labs assistance

From the academic side, in addition to leverage the American-Made Network, we would like to collaborate with research labs in the national labs to address the most important fundamental dynamics question in novel semiconductors materials and quantum devices, such as charge carrier photogeneration, recombination, trapping, transport, and charge transfer at the interface, which are essentially the basic scientific topics of BES. These national labs can be LBL, LLNL, SLAC, *etc*.