PV under a new light: how photovoltaic devices can revolutionize the IoT deployment

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The application of photovoltaic devices has recently widened, from the classical choice of terrestrial solar or space application, to more diverse light sources such as laser powered devices or more general conversion from indoor sources. These new scenarios require an evolution on the design of pv devices, not only in materials but also in device architecture. Furthermore, classical figures of merit used traditionally used for measuring performance must be rethought, as the conditions of application further away from the classical sun energy conversion.

In particular, indoor pv represents a true defy both in terms of device construction and metrology definition. The variety of light sources, combined with the wide range of incident light power that a device can receive inside and the power requirements of the particular IoT device, represent a huge depart from the traditional AM1.5 and requires new definitions for determining the validity of a certain device for being used as an indoor energy source.

Finally, the possibility of using our pv devices for other functionalities than energy conversion such as data reception, open a new world of opportunities for photovoltaics.

This presentation will be divided in three different parts. In the first one, we will discuss about how indoor pv performances can be correctly measured, and the key parameters to observe for guaranteeing the repeatability and validity of said measurements.

The second part will be dedicated to the main differences between a solar photovoltaic device and an indoor photovoltaic device and the main properties to look for when choosing PV materials for this application. As an example, the optimization of organic PV devices will be used.

The third part will be consecrated to implement on our indoor pv device a secondary functionality, in particular Visible Light Communication. The strengths and weakness of PV for this application will be discussed and examples on different technologies working on both energy conversion and data reception will be presented.

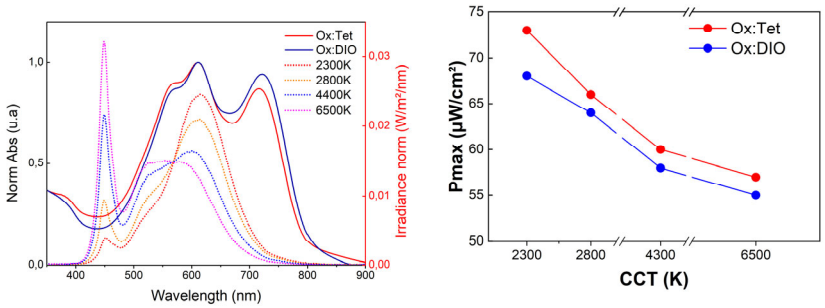

Fig 1: On the left, the superposition of the absorbance of two different organic photovoltaic devices (TDP-3F/ITIC-4F) with different LED sources. On the right, the electrical power delivered by these PV devices at 1000 lux for four different temperatures.