EUROPHOTONICS-POESII MASTER COURSE

PROPOSAL FOR A MASTER THESIS

Dates: April 1st, 2016 – September 30th, 2016

Laboratory : Organic Nano-structured Photovoltaics
City, Country : Barcelona, Spain

Title of the master thesis : Light Recycling in a Photonic Fiber Array

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Summary of the subject (maximum 1 page) :
Technology developments often focus on the optimization of the development usage while little attention is paid to other aspects which may eventually play a determining role in the success of the technology. A good example of this is found in liquid crystal based displays, which from the original low resolution monochromatic screens in handheld calculators evolved to offer, nowadays, top quality high resolution full color images. However, this evolution took place without much consideration for a proper management of the light emitted by the light emitting diode (LED). For instance, in a liquid crystal display (LCD) based smart phone just about 5% of the LED light is used for the actual LCD illumination. The rest is wasted as heat somewhere in the device.

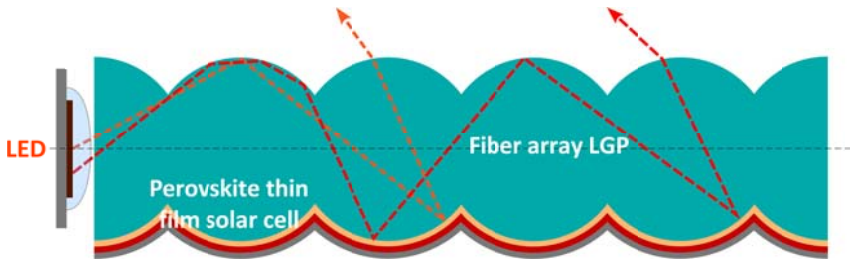

Figure 1 Light emitted by the LEDs is coupled into the fiber array guiding plate propagating in an interrupted chaotic whispering gallery mode.

To recycle a large part of this lost light, in this project we will consider the development of a new light guiding element based on a completely novel mechanism for light propagation which will eventually be used to replace the existing light guiding plate (LGP) used in current LCD devices. The guiding plate will be composed of a periodic array of periodic fibers (see Figure 1). Such periodicity will play a key role in all aspects of light management. In first place it can be shown that given the opening in between fibers, light propagation can be chaotic (see Figure 1), which ensures a well distributed and

homogenous exiting of the light from the top surface. Additionally, the ordered strucutre allows for the deposition on the bottom surface a cell to re-harvest the discarded light. The cell will be based on perovskite materials.

Keywords : Photovoltaics, Light guiding and trapping, Chaos, Perovskite solar cells

Additional information :

* Required skills : A BSc in Physics or Chemistry or an Engineering degree
* Miscellaneous :