Master in Photonics – "PHOTONICS BCN"
Master ERASMUS Mundus "EuroPhotonics"

MASTER THESIS PROPOSAL

Starting full time from April 2025
Presentation at the end of July or beginning of September 2025

Laboratory: Department of Electronic and Biomedical Engineering
Institution: Universitat de Barcelona
City, Country: Barcelona, Spain

Title of the master thesis: Solution-processed LED matrices on flexible substrates through inkjet-printed perovskites

Name of the master thesis supervisor and co-supervisor:
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Keywords: *Solution processing, inkjet printing, LEDs, perovskites*

Summary of the subject (maximum 1 page):

The growing incorporation of electronics into our day-to-day lives has been a result of consistent advancements that have led to simplification in device fabrication protocols, and the emergence of exotic semiconducting materials. Further expanding the boundaries of their capabilities is an ongoing effort, and is being achieved through the culmination the advances in materials science and industrially relevant technologies. In this regard, solution-processed nanomaterials have become a burgeoning choice, as the methodology involved is promising for obtaining efficient, facile and scalable device fabrication. Among the materials that hold promise for application in areas of optoelectronics, perovskites are on the leading edge owing to their exemplary properties, in addition to the relative ease with which they can be synthesized, especially via solution-based approaches. In order to incorporate them as active materials into devices, methods such as spin coating have been prevalent. In contrast to this, inkjet printing of functional inks which result in the formation of perovskite active layers is a highly sought-after method that offers the advantage for customised patterning of devices in a controllable and scalable manner. It is therefore of high interest to be able to establish structure-property correlations between printed devices and their performances.
Further, the emerging trends in electronics are indicative of a rising interest in the amalgamation of flexibility into devices for added functionality. Flexible displays for example, have been long sought

after and form an interesting scope of investigation, not only from a fundamental viewpoint but also for their highly lucrative and high impact technological weightage with a substantial market potential.

The proposed outline for this master project would cover a variety of areas of investigation to achieve matrices of perovskite LEDs on flexible substrates via inkjet printing. This would be carried out through identification of suitable materials design and fabrication strategies, in order for the printed layers to be incorporated as light emissive layer in LEDs. Constant feedback through simultaneous material characterization, as well as device characterization would be performed for optimization of performance. Upon achieving the optimal individual components, the design and realization of matrices with printed LEDs would be carried out for pixelated display applications. A final extrapolation of the developed technology would be aimed at incorporating such devices onto flexible substrates and their evaluation under flexure.

A list of the publications by us in this direction may be found here.

Objectives:

- Realize inkjet-printed perovskite layers as active layers in LEDs.
- Structuring of printed LEDs into matrices for pixelated displays.
- Translation of printed matrices of devices to flexible applications.

Additional information:

* Required skills: A keen experimentalist with an interest to explore and master materials design, device design and (opto-)electronics.
* Miscellaneous: Promising findings from these efforts can result in a publication.