



**HAL**  
open science

# A TOF-SIMS and XPS correlative protocol to minimise analysis-induced damage on organic light-emitting diode layers

Claire Guyot, Jean-Paul Barnes, Olivier Renault, Tony Maindron

► **To cite this version:**

Claire Guyot, Jean-Paul Barnes, Olivier Renault, Tony Maindron. A TOF-SIMS and XPS correlative protocol to minimise analysis-induced damage on organic light-emitting diode layers. ECASIA2022 - European Conference on Application of Surface and Interface Analysis, May 2022, Limerick, Ireland. cea-04653869

**HAL Id: cea-04653869**

**<https://cea.hal.science/cea-04653869v1>**

Submitted on 19 Jul 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# A TOF-SIMS and XPS correlative protocol to minimise analysis-induced damage on organic light-emitting diode layers

Claire Guyot<sup>1</sup>, Jean-Paul Barnes<sup>1</sup>, Olivier Renault<sup>1</sup>, Tony Maindron<sup>1</sup>

<sup>1</sup>Univ. Grenoble Alpes, CEA, Leti, F-38000, Grenoble, France

Keywords : OLEDs, TOF-SIMS, XPS, correlative analysis

## Abstract

The understanding of the degradation mechanisms due to aging is essential to improve the lifetime of organic light-emitting diodes (OLEDs) [1]. To identify the electro- and photo-chemical reactions occurring in the thin multilayers (~100 nm) during aging, a high depth-resolution technique capable of probing small chemical changes is required. Time-of-flight secondary ion mass spectrometry (TOF-SIMS) and X-ray photoelectron spectroscopy (XPS) are suitable characterization instruments for such analysis. Both techniques have already been used to investigate degradation mechanisms [2, 3]. However, few studies correlate the complementary results from the two techniques.

Here, we present a correlative protocol using a bevel crater to obtain precise chemical characterization of OLED layers and insight on the degradation mechanisms. This wedge crater is formed by varying the fluence of argon cluster ions over the surface of the sample. Measurements on the same bevel crater enable an easy correlation of the information of the two techniques. In TOF-SIMS, molecular information is collected by scanning the surface of the bevel crater, allowing the reconstruction of a profile with good depth resolution. Then, the sample is transferred to the XPS chamber using a transfer vessel under N<sub>2</sub> atmosphere. A linescan along the crater enables the localization of the different layers where high-resolution core-level spectra will be acquired to obtain information on the chemical environment of each element. As well as the easy correlation of the techniques, a reduction of the damage from the analysis and sputtering beams is also achieved with this protocol.

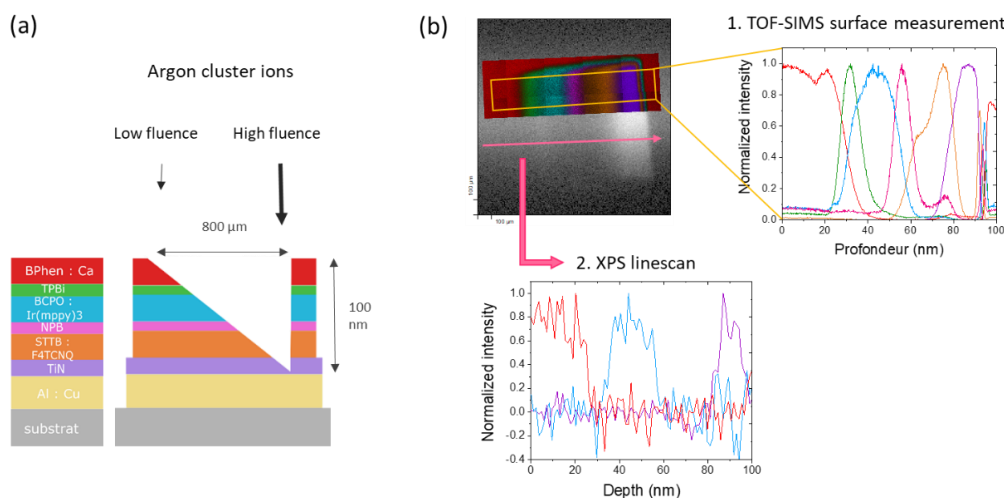


Figure 1. (a) Fabrication of the bevel crater by varying the argon cluster fluence at the surface, (b) Correlative protocol: 1. TOF-SIMS scan over the surface and reconstruction of the profile and 2. XPS linescan to localize the layers for acquisition of high resolution core-level spectra

## References

1. Scholz, S., et al., Degradation Mechanisms and Reactions in Organic Light-Emitting Devices. Chemical Reviews, 2015. 115(16): p. 8449-8503.
2. Rabelo de Moraes, I., S. Scholz, and K. Leo, Influence of the applied charge on the electro-chemical degradation in green phosphorescent organic light emitting diodes. Organic Electronics, 2016. 38: p. 164-171.
3. Lin, W.-C., et al., Migration of small molecules during the degradation of organic light-emitting diodes. Organic Electronics, 2009. 10(4): p. 581-586.

## Acknowledgements

(Part of) this work, carried out on the Platform for Nanocharacterization (PFNC), was supported by the “Recherches Technologiques de Base” program of the French National Research Agency (ANR).