

# Analysis of Damaged Components during Electrodes Formation in OLED Devices

LESA (Liquid Extraction Surface Analysis)-nanoESI-MS is a extremely soft ionization in surface analysis, thus it is possible to determine whether detected ions as decomposition components or fragment ions in deterioration analysis of OLED devices.

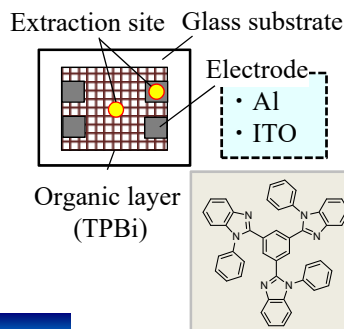
## Background

It is supposed that an organic layer is damaged by forming an electrode in OLED devices.

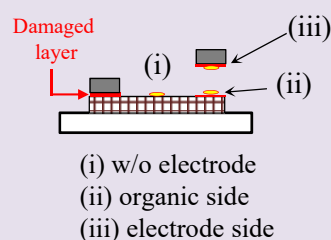
⇒ Elucidation of the degradation mechanism will guide the design and manufacture of the devices.

LESA-nanoESI-MS method was applied to two kinds of devices using TPBi for organic layers and Al and ITO for electrodes in order to identify the decomposition products and denatured compounds generated by forming an electrode.

## Device Details

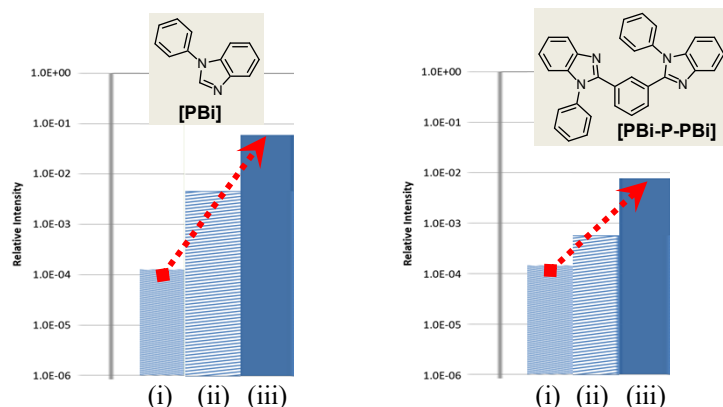


## LESA extraction site



## Decomposition of TPBi Generated by Al Deposition

Compared the strengths of the degradants at the measurement points, taking the ionic strength of TPBi at each measurement as 1.



- Several ions presumed to be degradants such as [PBi] and [PBi-P-PBi] were detected in addition to an ion of TPBi.



In nanoESI method, which is a soft ionization, molecular ions can be detected without fragmentations, so that it can be estimated that these decomposition products were generated during electrode film formation.

- The amount of decomposed material is larger at (i) w/o electrode than at (iii) electrode side.



The tendency of the organic film to be damaged was recognized by the formation of electrode.

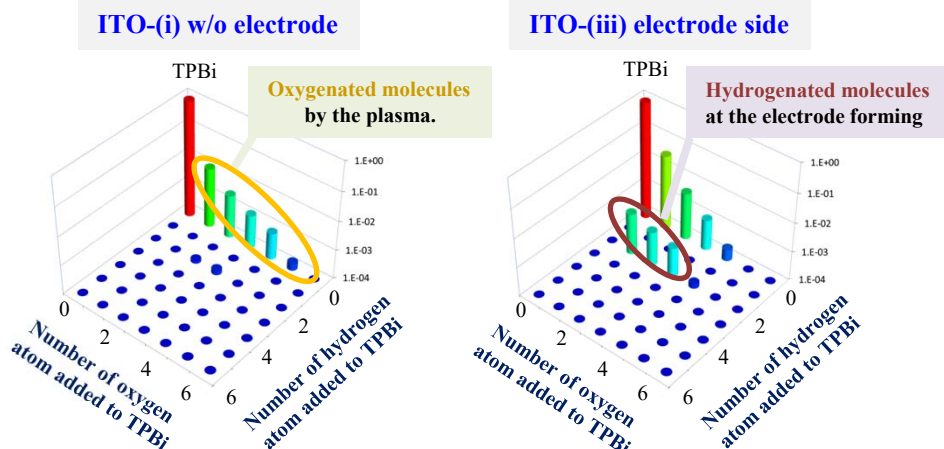
## Oxygenated and Hydrogenated TPBi by ITO Formation

### (i) w/o electrode

Some ions derived from oxygenated molecules with one to five oxygen atoms added to TPBi were detected due to oxygen plasma generated during ITO formation.

### (iii) electrode side

By forming an electrode, some ions derived from hydrogenated molecules in which hydrogen atoms are added to oxygenated TPBi were detected.



Trace decomposition products and redox degradation products, which could not be estimated as degradation components in other methods, could be detected and identified by using LESA-nanoESI-MS.