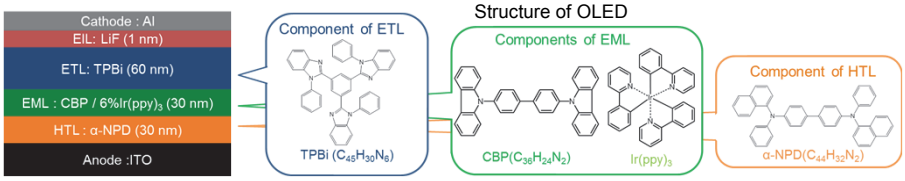
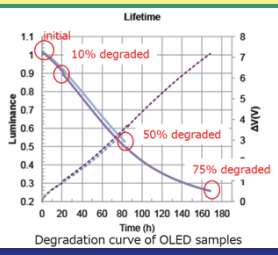
TOF-SIMS MS/MS for analysis of degradation product in OLED driving test

PL line analysis, GCIB-TOF-SIMS, and TOF-SIMS MS/MS were applied to the degradation analysis of OLED in driving test. TOF-SIMS MS/MS revealed the detailed chemical structure of degradation product in the specific depth region in OLED stacks.

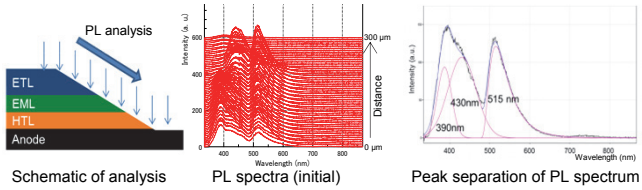
■ test pattern size: 2 mmφ ■ driving test: initial, 10%, 50%, and 75% degraded





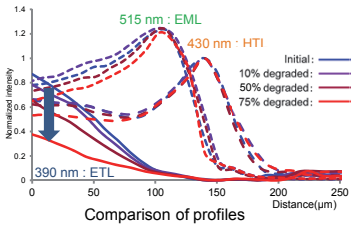
Degradation curve of OLED samples

PL analysis of inclined surface



Schematic of analysis | PL spectra (initial) | Peak separation of PL spectrum

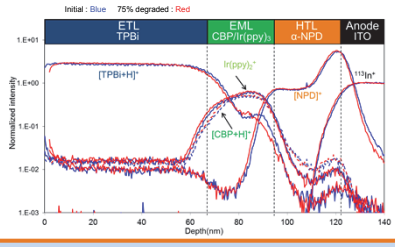
Comparison of profiles of PL intensities



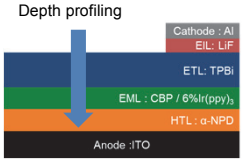
Comparison of profiles

Decrease of peak intensities in ETL
⇒ Degradation of ETL components

GCIB-TOF-SIMS depth profile of OLED

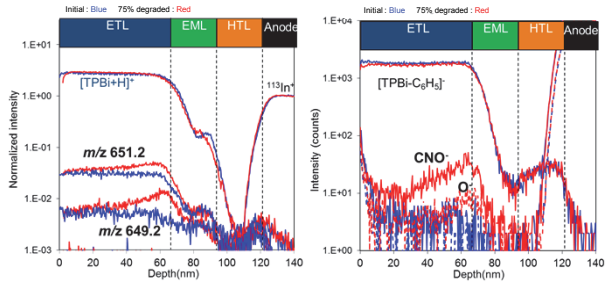


Depth profiling



Intensities of main components and dopant were not changed after degradation.

Difference between the spectra of each layer ⇒ Depth profile

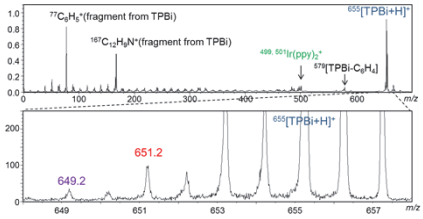


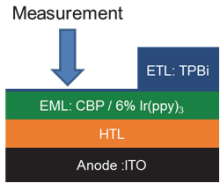
Degradation at EML ~ EML/ETL interface
⇒ Corresponding with PL results, *m/z* 649, 651 peaks were obtained from degradation products

TOF-SIMS MS/MS

Ar-GCIB etching to ETL/EML interface ⇒ TOF-SIMS analysis

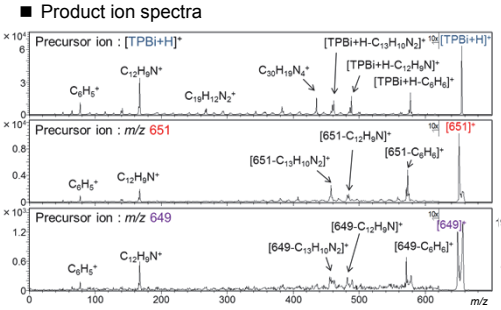
■ TOF-SIMS mass spectra of ETL/EML interface

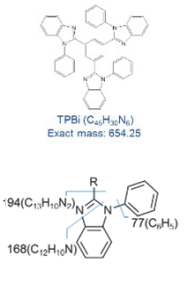




Insufficient information in MS spectra ⇒ MS/MS analysis

■ Product ion spectra

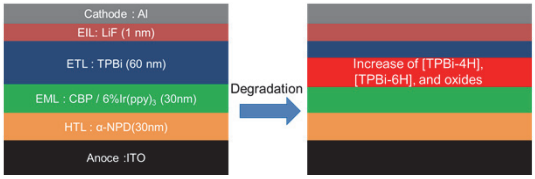


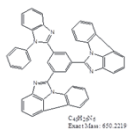


Degradation products can be assigned as derivatives of TPBi, [TPBi-4H] and [TPBi-6H].

Peaks in low *m/z* were common.
Shifts of peaks in high *m/z* were common. ⇒ Cyclization of TPBi

Summary




An example of [TPBi-4H]

PL line analysis, GCIB-TOF-SIMS, and TOF-SIMS MS/MS were applied to OLED degradation analysis.
These techniques revealed the detailed chemical structure of the degradation product in the specific depth region in OLED stacks.