Depth profile analysis of organic materials by GCIB-TOF-SIMS

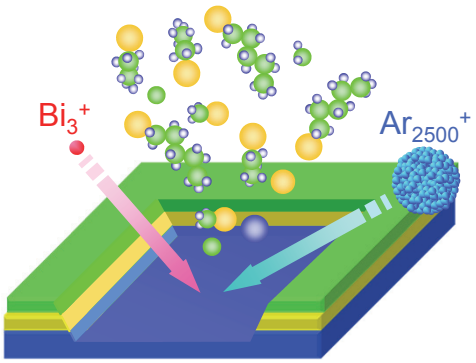
By depth profile analysis using GCIB, which is low-damage etching ion beam, depth distribution of organic molecules can be obtained with high sensitivity and high accuracy. GCIB-TOF-SIMS analysis is a very effective technique for evaluation of organic samples in terms of multilayer structure, distribution and degradation of organics.

Feature of GCIB (Gas cluster ion beam)

(1) The kinetic energy per one element of GCIB is much smaller than conventional etching source, such as Cs^+. Etching of organics with low damage to molecule is possible.

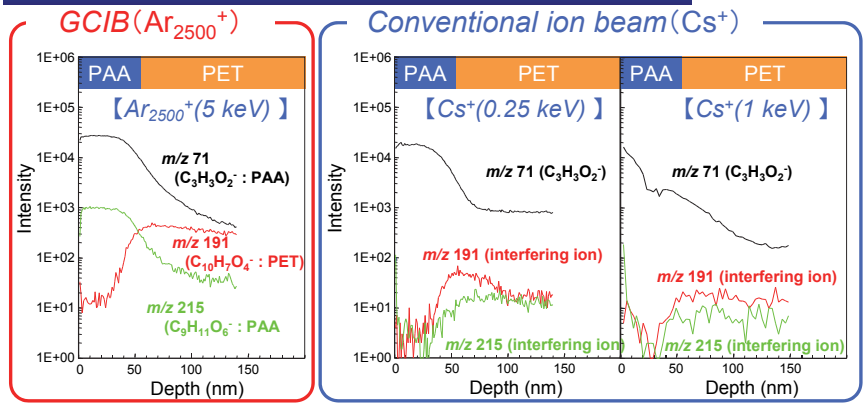
→ Organic depth profiling in combination with surface analysis (e.g. TOF-SIMS)

(2) GCIB-TOF-SIMS analysis has higher depth resolution than line analysis of crosssection, and higher accuracy than line analysis of angle cut surface.



Schematic diagram of GCIB-TOF-SIMS

Analysis of PAA/PET film



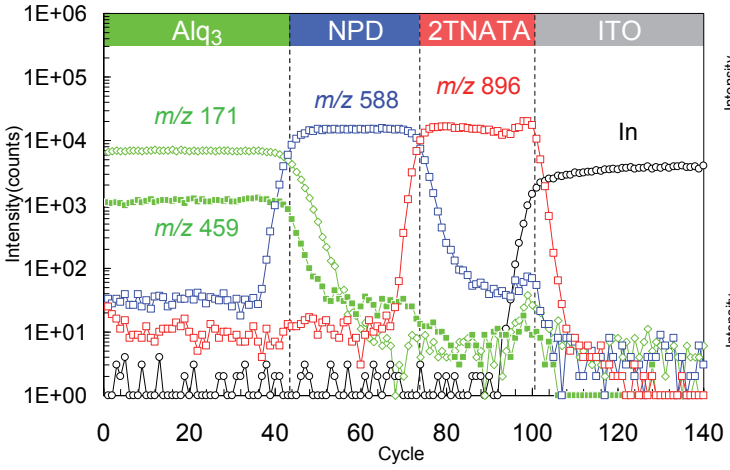
GCIB(Ar_{2500}^+)
- Etching damage : low
- Repeat unit of polymer was detected.
  PAA: $^{71}C_3H_3O_2^-$, $^{215}C_9H_{11}O_6^-$
  PET: $^{191}C_{10}H_7O_4^-$
- Polymer multilayer structure was observed.

Conventional ion beam (Cs^+, O_2^+)
- Etching damage : high
- Polymer multilayer structure cannot be observed.

PAA: polyacrylic acid、 PET: polyethylene telephthalate

Analysis of OLED

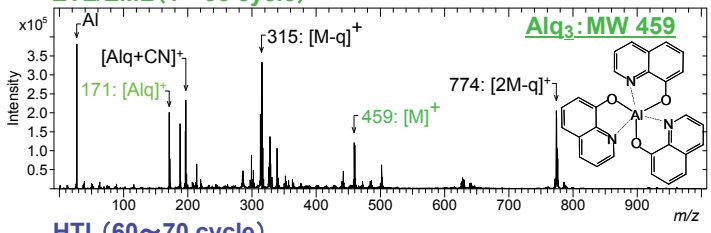
【Depth profile of molecular ions】



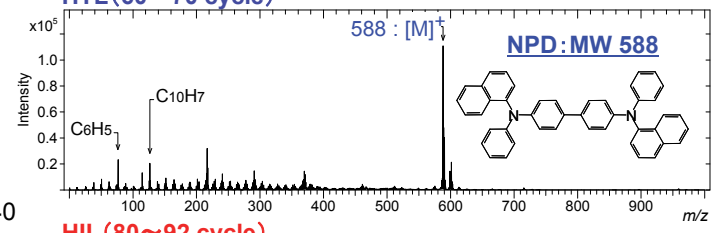
【Mass spectrum of each layer】

ETL/EML (1～35 cycle)

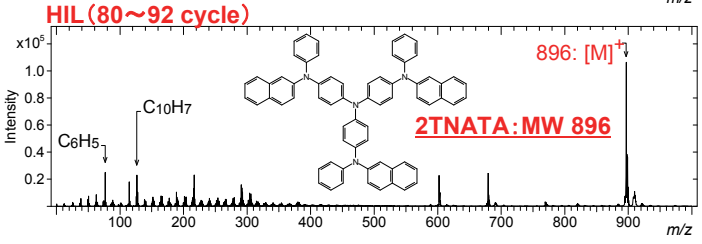
q: 8-quinolinol (C_9H_6NO)



HTL (60～70 cycle)



HIL (80～92 cycle)



- Depth profile of each molecule with high accuracy was obtained by GCIB-TOF-SIMS analysis.
- Molecular ion and fragment ions were strongly observed in mass spectrum of each layer.
- Etching damage by GCIB is low enough to obtain the mass spectrum of each molecule.