Analytical Criteria to Expand the Applications of GCIB Depth Profiling with TOF-SIMS

John S. Hammond[1], Takuya Miyayama[2], Noriaki Sanada[2], Atsushi Takahara[3], Gregory L. Fisher[1], Scott R. Bryan[1], and Akira Yamamoto[2]

1. *Physical Electronics, 18725 Lake Drive East, Chanhassen, MN, USA, 55317*
2. *Ulvac-PHI, 370 Enzo, Chigasaki, Kanagawa, 253-0084, Japan*
3. *Kyushu University, 744 Motooka, Nishi-ku, Fukuoka City 819-0395, Japan*

jhammond@phi.com

Recent publications have demonstrated the potential of Gas Cluster Ion Beams to provide "non-destructive" depth profiling of polyimide polymer materials for which C_{60}^+ and Coronene$^+$ cluster ion source produce significant damage during analogous depth profiling experiments[1]. To expand the potential for GCIB depth profiling with surface analysis techniques such as TOF-SIMS and XPS, it is important to characterize a range of experimental conditions. In this study, the impact of incident cluster ion energy, angle of incidence and sample rotation during sputter depth profiling will be discussed for different compositions of polyimides and other polymer materials. The uniformity of chemical and molecular intensities during the depth profile as well as the surface roughness measured by an AFM at a sputter depth up to 1 µm are used to define the optimal GCIB analyses conditions.

Based on these optimized instrumentation parameters, TOF-SIMS depth profiling with GCIB of model Organic Light Emitting Diodes (OLEDs) and Organic Photovoltaic (OPVs) samples will be presented. The changes in molecular composition and layering structures for as deposited and annealed OPV structures can be identified from the TOF-SIMS depth profiles. The quantification and depth gradients of a molecular dye in OLED materials measured with GCIB TOF-SIMS depth profiling will be reviewed.

1. Takuya Miyayama, Noriaki Sanada, Scott R. Bryan, John S. Hammond and Mineharu Suzuki, *Surf. Interface Anal.* 2010, *42*, 1453–1457.