Advances in 3D TOF-SIMS Imaging:
From Depth Profiling to FIB Sectioning

G. L. Fisher[1*], S. R. Bryan[1], S. Iida[2] and C. Szakal[3]

[1]*Physical Electronics, 18725 Lake Drive East, Chanhassen, MN 55317*
[2]*Ulvac-Phi, Inc., 370 Enzo, Chigasaki City, Kanagawa 253-8522, Japan*
[3]*NIST, 100 Bureau Drive MS8371, Gaithersburg, MD 20899*
*gfisher@phi.com

Abstract

Even under optimized experimental conditions, the efficacy of sputter depth profiling for 3D TOF-SIMS imaging is limited to < 5 μm in the case of a "favorable" matrix and to < 300 nm in the case of an "unfavorable" matrix. An alternative approach for 3D TOF-SIMS imaging the interior of an organic or an inorganic specimen is to utilize FIB milling and sectioning. With FIB milling, the interior of a specimen is revealed to depths ≥ 50 μm within a reasonable analytical timeframe. Additionally, 3D chemical imaging of ~ 10 μm deep volumes may be achieved in less time than it would take to perform a low voltage sputter depth profile. Recent experiments indicate that FIB straggle (i.e. beam-induced damage) may be removed via C_{60} cluster ion beam sputtering to recover characteristic signals in an organic matrix; however, there is some indication that even this C_{60} cleaning step may not be necessary. The union of successive FIB sectioning and TOF-SIMS analysis cycles to achieve 3D chemical imaging will be discussed and illustrated using both inorganic and organic examples.