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

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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 \(\geq 50\) µm within a reasonable analytical timeframe. Additionally, 3D chemical imaging of \(\sim 10\) 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.