

3D TOF-SIMS Imaging of Organic and Inorganic Specimens with FIB Sectioning and C₆₀ Ion Polishing

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An alternative approach for chemical imaging the interior of an inorganic or an organic specimen by TOF-SIMS imaging is to utilize FIB sectioning. Publications to date concerning the FIB sectioning and analysis of such samples, particularly organics, have been restricted to imaging the inorganic species by SEM-EDS. The union of FIB sectioning and TOF-SIMS analysis to achieve chemical imaging has been impeded by the difficulty of collecting secondary ions from the vertical FIB sidewall that is probed by the analytical primary ion beam. Since the ultimate objective involves 3D reconstruction of successive 2D chemical images, it is highly advantageous to perform consecutive sectioning and analysis cycles without moving the sample. Therefore, in order to image the vertical sidewall of a FIB crater without moving (i.e. tilting) the sample, the TOF-SIMS analyzer must have as characteristics a large depth-of-field and a large solid angle-of-collection. The advantages and challenges of joining FIB and TOF-SIMS will be demonstrated and discussed. Recent developments concerning the use of FIB sectioning for 3D characterization of heterogeneous materials will also be demonstrated and discussed. Finally, we will discuss the application of cluster ion beams to recover the characteristic molecular signals within the FIB-milled area of organic specimens.