

Cluster Ion Beams - Potential Benefits and Applications

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The analysis of organic solids surfaces by static SIMS has been improved over the years. In spite of all the advantages in this field, there are still many challenges in tapping the full potential of molecular SIMS. In particular, molecular imaging requires the highest sensitivity since the number of available molecules is very limited.

A successful approach to increase the SIMS sensitivity for the analysis of organic surfaces is the use of polyatomic primary ions. Their application to organic surfaces greatly enhances the chemical information given by the emission process. Compared to monoatomic primary ion bombardment the use of polyatomic primary ions leads to a considerable enhancement of the secondary ion yield up to several orders of magnitude. As the corresponding increase in damage cross section is smaller, the ion formation efficiency also increases significantly.

Recent advances in molecular surface analysis were made by the application of cluster liquid metal ion sources (LMIG) operated with Au or Bi. In particular the Bi source offers excellent prospects for organic surface analysis since it combines the fundamental benefits of cluster ion bombardment with a high brightness source allowing to push the lateral resolution in organic imaging down to the 100 nm range. Even at low emission currents stable operation is achieved and this is advantageous with respect to life time and performance of the source (energy spread). For the first time lateral resolution and mass resolution comparable to Ga sources is accessible using cluster primary ion species.

In addition the use of C₆₀ as the most efficient projectile for organic surface analysis is discussed. Beyond the static limit the application of C₆₀ allows organic depth profiles on selected organic multilayer systems.