

How Does Static Secondary-Ion Mass Spectrometry Work?

Secondary Ion Mass Spectroscopy (SIMS) is a technique used to analyze the composition of a solid surface using ion beams. A focused ion beam is directed onto the surface of a sample. When the ion beam hits the sample, molecules, neutral atoms or ions are disrupted. This gives rise to an effect called sputtering. A small fraction of these particles are emitted as ions, called secondary ions. The secondary ions are collected and analyzed by a mass spectrometer and a spectrum is generated. The spectrum output provides the elemental, isotopic, or molecular composition of the surface.

Static secondary ion mass spectrometry (SSIMS) is a variation of secondary ion mass spectroscopy and is based on the same physical process. In static secondary ion mass spectrometry (SSIMS), very low ion fluxes are used to ensure that the ions will impact upon an undamaged sample surface and that the sputtered secondary ions are representative of the original surface, rather than the surface that may be damaged from earlier ion impacts. An important feature of static secondary ion mass spectrometry is its ability to detect very small amounts of materials on the surface. Static secondary ion mass spectrometry is recognized as a highly sensitive analytical technique for chemical analysis. The chemical structure and elemental composition of the molecular layer (uppermost atomic layer) of a solid can be determined, including the nature and properties of adsorbed areas. Static SIMS is an excellent method for mapping a surface and can provide a surface map of atoms and molecules of both organic and inorganic species of a sample.

Static secondary ion mass spectrometry is widely used for polymer analysis because a great deal of information such as identification, detection of surface functionalities, study of segregation of copolymer components and molecular weight distributions can be determined. In addition to the qualitative identification, SSIMS allows high reproducibility and therefore permits quantitative studies with the aid of standards. SSIMS also provides imaging capabilities to visualize directly the distribution of given components within the upper surface layer of a solid material. Static secondary ion mass spectrometry is a reliable technique for polymers because it can detect organic molecule fragments to the part per million (ppm) and/or part per billion (ppb) level and can detect the chemical information of the types of atoms, clusters and molecules with very high specificity. Due to its ability to identify the molecular structure i.e. type of molecules at the surface, the SSIMS technique has been extensively applied for many years for polymer analysis and gives complete information on polymer surface chemistry.

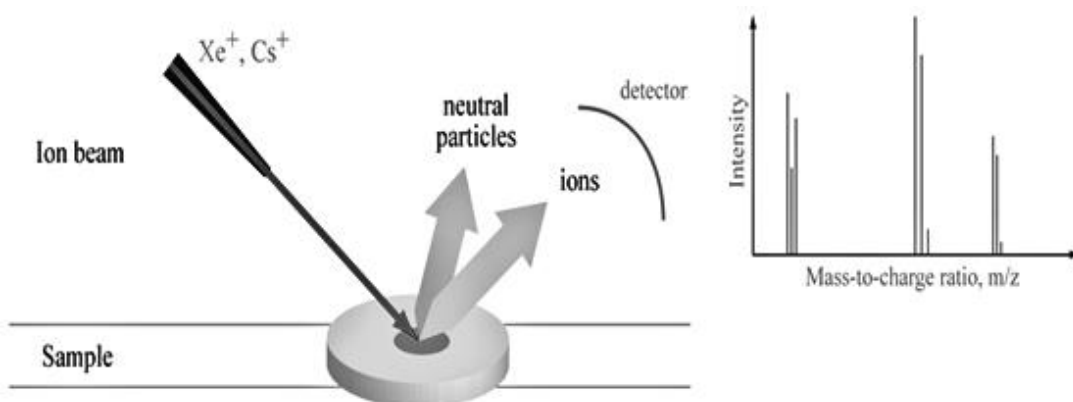


Figure shows concept of SSIMS technique