

OT5 Exploration of the suitability of Sensitive High Resolution Ion Micro Probe (SHRIMP) to Nuclear Particle Analysis

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The SHRIMP-IIIE has proved to be a useful tool for analysis of nuclear industry generated particles

Nuclear safeguards employs a variety of tools for ensuring the compliance of non-proliferation treaty signatories with their declared operations. Environmental sampling is one such tool, involving the analysis of material collected from within and around declared or suspected nuclear facilities to detect and characterise nuclear material. Techniques such as mass spectrometry are routinely employed to analyse such environmental samples in bulk. Increasingly, however, techniques are being sought to study individual particles from these samples. Typically a combination of techniques are used, firstly to identify and isolate nuclear material particles (SEM, Fission Track Radiography), and to then measure the composition of the particles with high sensitivity (TIMS).

Sensitive High Resolution Ion Microprobe (SHRIMP) is a well established technique for analysis of trace levels of high mass isotopes routinely used in geochronology. SHRIMP is a large SIMS with high mass resolution sufficient to resolve most molecular interferences. This instrument allows for analysis of numerous untreated, individual particles loaded on a single sample mount. The preparation of sample mounts for SHRIMP analysis is also significantly simpler than the preparation of filaments for TIMS or aqueous samples for an ICP-MS, allowing rapid switching between measurements of individual particles.

We have demonstrated the suitability of the SHRIMP-IIIE for analysis of plutonium and uranium isotopic ratios in micron-sized particles of nuclear safeguards interest.