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Abstract.

This paper details an improved approach to environmental particle analysis for safeguards by means of a combination of an upgraded version of the so-called fission track method with state-of-the-art microscope and microprobe techniques. Improvements to the fission track method comprise a novel sample assembly, the automation of several of its steps and the extensive use of correlative microscopy. This is followed by an automated isolation of particles-of-interest by means of laser micro-dissection (LMD) and their collection onto a harvester for transfer to other micro-analytical instruments for further analysis. The samples examined in this contribution were analysed for their nuclear material signatures, in particular the presence of uranium isotopes. The length of a single analysis cycle herewith was reduced to 12 days.

Keywords: Fission Track, Correlative microscopy, Safeguards, LMD, LA-ICP-MS, Environmental Swipe Samples

1. Introduction

The analysis of Environmental Samples (ES) collected from nuclear facilities is an important tool for Safeguards (SG) at the International Atomic Energy Agency (IAEA). Microparticles from ESs are routinely individually screened for their actinide content and then microprobed using a range of techniques. In general, two main approaches are used: probing a large number of particles to identify the actinide-containing micro artefacts (Particles of Interest – POIs) during the data analysis step; or sifting and identifying the POIs before analysis in order to submit only a small number of particles for detailed processing.

Since the 1970s, the fission track (FT) method has been used along with other screening techniques to identify POIs and almost 50 years later it is still being employed at the IAEA and other monitoring organisations . It is a simple, robust and reliable method for single particle detection and is usually followed by isotope ratio analysis by means of Thermal