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Age Dating of Uranium Particles

Analysis of environmental samples provides detailed technical information useful in the verification of a state's nuclear declaration. Analysis of particulates provides highly specific information on materials painting a detailed picture of ongoing facility activities and enabling reconstruction of historical activities. Additional useful information can be gleaned from a measurement of uranium particle purification date. Large geometry SIMS enables precise measurement of uranium and decay daughters enabling direct computation of the purification date of uranium particulate collected in environmental samples. Accurate purification measurements are dependent on extremely tight control of all instrument operating parameters and a good understanding of the element relative sensitivity factors, instrument detector background, potential interferences, matric effects, and the statistics and proper interpretation of low-to-zero counts of the uranium daughters. The methodology described was successfully applied to uranium particle standards, process uranium materials, and on particles collected from environmental swipes. Enrichments of particles measures ranged from LEU to HEU and equivalent particle sizes ranged from a few tens to around one micron. Results showed excellent agreement with known purification dates. The project also demonstrates potential utility of combining isotopic and potentially other data to determine appropriate clusters for data aggregation. Aggregating data from clusters of related particles can provide a pseudo-bulk result that significantly reduces the measurement uncertainly associated with the individual particles.

Which "Key Question" does your Abstract address?

SGI4.1

Topics

SGI4

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