Measuring the number concentrations and sizes of nanoparticles in soils and other solid environmental matrixes by laser ablation single particle ICPMS

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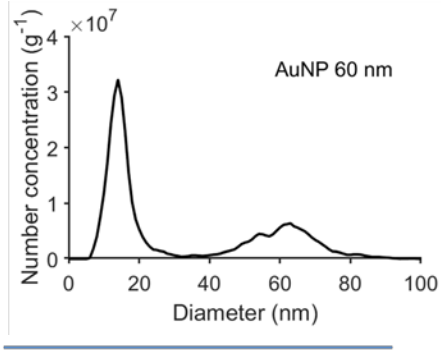

Figure 1. 60 nm Au nanoparticles sized by Laser ablation-SPICPMS in soil. The peak at ~ 60 nm are intact particles while the one at ~ 20 nm is an artefact arising from background Au content.

Single particle ICPMS (SPICPMS) is becoming accepted as a standard method for measuring environmental nanomaterials contamination. The technique has so far been restricted to liquid dispersions. We have developed a method of depositing soil in 10-15 µm thick layers on double sided tape pieces for laser ablation. Nano sized particles are mostly transferred intact into the plasma, and Au particles were accurately sized up to at least 250 nm while background noise set the detection limit to ~ 20 nm (Figure 1). Knowing the ablated area and weight of the soil on the tape piece one can calculate the concentration in soil from the number of detected particles. This requires that the transport efficiency of transferring particles from the soil into the plasma is close to 100 %. An alternative is to measure an analyte spiked into the soil in a known concentration to determine the ablation rate into the mass spectrometer. The instrument was calibrated using a T-section that allowed correction for ionization suppression due to the ablated solids by injecting the dissolved and particulate standards while simultaneously ablating a blank soil. The method was tried on a range of related sample types including Au particles in fly ash and aluminum oxides in powdered noodles.