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Comparison of analytical performance of sp-ICP-TOFMS using three different cone combinations and a desolvation system

Content

Single particle inductively coupled plasma time of flight mass spectrometry (sp-ICP-TOFMS) coupled to a continuous flow analysis (CFA) system (Erhardt et al. 2019) allows for high resolution elemental analysis of single dust particles in ice cores over the full mass range. To make full use of sp-ICP-TOFMS for the geochemical characterization of single dust particles in deep ice cores, it is necessary to improve its analytical sensitivity and reduce the interferences such as oxides and hydrides in the ICP-TOFMS instrumentation, because deep ice cores contain mineral dust elements at the ultra-trace level in highly thinned layers. In this study, we compare the analytical performance (i.e. sensitivity, resolution, production of interferences, and transport efficiency) of sp-ICP-TOFMS with three different cone combinations and using a high sensitivity desolvation sample introduction system (APEX Omega, ESI). The transport efficiency and sensitivity of sp-ICP-TOFMS increased by a factor of about five and two to five, respectively, in presence of the desolvation device considerably reducing the production of oxides in the instrumentation. This holds true both for dissolved background concentrations and for single dust particles in the meltwater stream. Thus, we can show that implementation of a multistage Peltier-cooled desolvation system in series with a helical EPTFE fluoropolymer membrane desolvator (as jointly used in the APEX Omega), can be successfully applied in single particle analysis of ice cores. Although the use of a special cone set for dry plasma conditions approximately made a twofold gain in the sensitivity for the low mass range, the overall improvement in analytical performance from different cone sets was not obvious compared with that from the desolvation unit.

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