A signal deconvolution method to discriminate smaller nanoparticles in single particle ICP-MS

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Abstract

Single particle ICP-MS (spICP-MS) analysis of inorganic nanoparticles (NPs) cannot accurately distinguish dissolved ion signals and signals from relatively small NP, although these particles are often more reactive than their larger counterparts. A signal deconvolution method was developed for spICP-MS analysis using gold (Au) NPs of nominally 10, 15 or 30 nm diameter. The signal distributions of dissolved Au standards were parameterised as a function of concentration using a mixed Polyagaussian probability mass function. Dissolved curves were fitted using this parameterisation to the low-intensity signals of samples containing NPs to subtract and deconvolute the dissolved signals from the particle signals. The dissolved signal was quantified in this process. The accuracy of the deconvolution method was confirmed for all NP suspensions studied when comparing the size and number concentration obtained with the deconvolution method with values based on transmission electron microscopy. This method thus allows analysis of NP suspensions with spICP-MS where this was hitherto not possible. The applicability domain lies predominantly with relatively small NPs and/or when a relatively high concentration of dissolved ions of the element of interest is present, where overlap between dissolved and particulate signal occurs.

Reference

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