

Determination of number concentration of inorganic nanoparticles using spICPMS: Recent developments and remaining challenges

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Measuring the number concentration of nanoparticles in colloidal suspension is a major interest for a large range of industries including pharmaceutical, personal care and cosmetics, food packaging, biomedical, etc.

Such measurement capabilities may help industry comply with potential EU regulation (e.g. cosmetic regulation 1223/2009) linked to the EU definition of nanomaterial (2011/696/EU) [1]. They will also be invaluable for industry to ensure the quality and efficacy of products.

The potential of single particle ICPMS (spICPMS) has been demonstrated for the determination of size and number-based concentration of inorganic nanoparticles (NP) in several publications [2]. The literature suggests that the most widely used approach so far relies on the use of reference materials (RM) to determine the transport efficiency, which is a key parameter that significantly impacts the accuracy of the number-based concentration data. However, RMs and more importantly like-for-like RMs are rather scarce and, to the author's knowledge, there is no RM certified for particle number concentration. Moreover, there is no SI traceable method to determine NP number concentration.

This lecture will discuss key challenges of spICPMS for achieving accurate number concentration of nanomaterials. It will present our recent developments under the frame of European Metrology Programme for Innovation and Research (EMPIR Innanopart: Metrology for Innovative Nanoparticles) to achieve SI-traceability for number concentration without the need for reference materials to determine the transport efficiency. The power of using complementary techniques (e.g. particle tracking analysis) for data confirmation will be demonstrated.

[1] EC Commission Recommendation 2011, 2011/696/EU, Luxembourg: European Commission.

[2] Montaña MD, Olesik JW2, Barber AG, Challis K, Ranville JF, *Anal Bioanal Chem.* 2016, 408(19): 5053-74.