European Winter Conference on Plasma Spectrochemistry

Ljubljana, Slovenia,
January 29th – February 3rd , 2023

Book of Abstracts

NATIONAL INSTITUTE OF CHEMISTRY

EWCPS

Book of abstracts of the 19th European Winter Conference on Plasma Spectrochemistry

Publisher:
National Institute of Chemistry
Hajdrihova 19
1000 Ljubljana
Slovenia

Editors:
Vid Simon Šelih and Martin Šala, National Institute of Chemistry, Slovenia

Graphical design:
Repster

Ljubljana, January 2023
Publication is not for sale

Kataložni zapis o publikaciji (CIP) pripravili v Narodni in univerzitetni knjižnici v Ljubljani
COBISS.SI-ID 139103747
ISBN 978-961-6104-85-2 (PDF)

Sample preparation strategies for nanoparticles analysis using laser ablation sampling single particle–ICP-MS

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Nanoparticles are used in a wide variety of fields, including material manufacturing, energy production, food processing, consumer goods as well as life sciences. Using materials in the nanometre size range changes their physicochemical properties drastically from those of the associated bulk materials creating novel characteristics useful for products such as catalysts, medical products, food technology, cosmetics and other household items, among many others. [1], [2] This widespread use in consumer goods raises questions about the impact of nanoparticles on the environment and human health. With single particles inductively coupled plasma mass spectrometry (SP-ICP-MS), a powerful tool for investigating nanoparticles was developed. [1]

However, conventional SP-ICP-MS allowing the simultaneous determination of particle size and number concentration, is limited to nanoparticles in suspensions meaning solid samples containing nanoparticles have to be dissolved, keeping the nanoparticles intact. Required sample pretreatment steps might induce changes in the occurrence of the prevailing nanoparticles (e.g., size distribution and number concentration). To overcome the problems associated with the preparation of stable sample suspensions, the measurement of the solid samples is recommended. The combination of laser ablation as the sampling technique and SP-ICP-MS for the analysis was introduced to include the benefits of solid sampling. [2] [3]This approach allows the sizing and counting of nanoparticles directly in a solid matrix with the advantage that embedded nanoparticles can be stored without changes in particle size. Moreover, spatially resolved information is accessible. [2], [3]

Similar to conventional SP-ICP-MS, LA-SP-ICP-MS also requires nanoparticle standards for signal evaluation. For this purpose, gelatine standards were prepared and investigated with laser ablation SP-ICP-MS. [3] In this work, dispersions of metallic and ceramic nanoparticles in polymer matrixes were produced using different sample preparation techniques. The goal was a random distribution of the nanoparticles within the standard, creating isolated nanoparticles with no agglomeration. The influence of the sample preparation procedures, as well as the impact of the laser wavelength and energy in the ablation process, were investigated and compared to aid in the further development of LA-SP-ICP-MS within various kinds of sample matrixes.

Laser ablation, Single particle analysis, Nanoparticles, Sample preparation

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