Emerging techniques in nanoparticle analysis

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Techniques available

Light scattering based techniques:

- Widely used however severe limitations
- Difficulties with polydisperse samples (high PDI, PDI is representative of the particle size distribution width)
- Sensitive to matrix components
- Not element specific

Imaging techniques:

- Formation of artefacts, matrix effects

Demands

- Particle size
- Particle number concentration
- Elemental composition
- Differentiation between natural and engineered nanoparticles
- High throughput and robustness

spICP-QMS

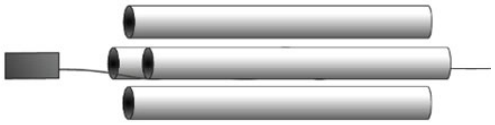
✧ great potential for the characterization of inorganic nanoparticles (NPs) at relevant concentrations (ppt)

✧ enables the measurement of individual particles (PNC)

Limitations

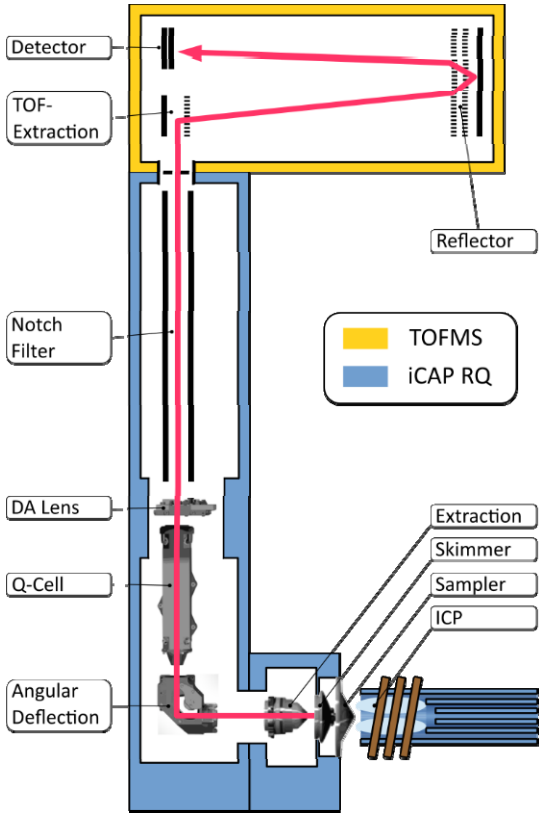
- Only two elements at the individual particle

Quadrupole

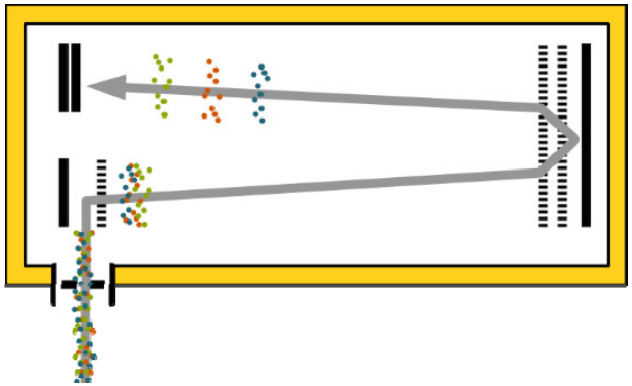


✧ analysis of more complex multi-component particles, which are more realistic case, **another mass analyzer is required**

spICP -TOF- MS



Time-of-flight



- Complete elemental mass spectra for individual NPs
- All isotopes from an individual particle
- Complex particles, complex samples

The most important feature in regard to single particle analysis is simultaneous detection and speed

Example

Complex environmental samples

- CeO_2, TiO_2, SiO_2, Al_2O_3, CuO, ZnO
- Elements are present in the environment at high concentrations
- Engineered particles at very low levels
- Lack of techniques to discriminate

Solution

- Single particle fingerprinting