

Technical University of Denmark



## Quantifying shape, size, and composition distributions of nanoparticle aerosols by impaction and electron microscopy

**Bluhme, Anders Brostrøm; Kling, Kirsten; Koponen, Ismo K.; Mølhav, Kristian**

*Published in:*

Book of Abstracts, Sustain 2017

*Publication date:*

2017

*Document Version*

Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*

Bluhme, A. B., Kling, K., Koponen, I. K., & Mølhav, K. (2017). Quantifying shape, size, and composition distributions of nanoparticle aerosols by impaction and electron microscopy. In Book of Abstracts, Sustain 2017 [U-2] Technical University of Denmark (DTU).

## DTU Library

Technical Information Center of Denmark

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

## Quantifying shape, size, and composition distributions of nanoparticle aerosols by impaction and electron microscopy

Anders Brostrøm<sup>\*1,2</sup>, Kirsten Kling<sup>2</sup>, Ismo K. Koponen<sup>2</sup>, Kristian Mølhave<sup>1</sup>

1: Technical University of Denmark, Department of Micro- and Nanotechnology, Ørsteds Plads, Building 345B, DK 2800 Kgs. Lyngby, Denmark

2: National Research Centre for the Working Environment, Lersø Parkallé 105, DK 2100 Copenhagen, Denmark

\*Corresponding author email: abbl@dtu.dk

Air pollution has become a growing concern in the past few years and is now recognized as one of the major contributors to the global burden of disease, with particulate matter as one of its central concerns. Here nanoparticles, PM<sub>1</sub> and PM<sub>2.5</sub> have been shown to pose the greatest risk due to their ability to penetrate deep into the lungs. Particles are released from a wide range of both natural and anthropogenic sources, where especially the transport sector is a major contributor. Simultaneously the use of nano materials in every day products is growing rapidly, bringing new exposure scenarios for both workers and users. As a result there is a need for exposure and risk assessments associated with the fabrication, use, and disposal of nano containing products, as well as in rural and general ambient environments. However, most of the current standard instruments bring no knowledge of particle composition or shape, which has recently been identified as crucial parameters in toxicological studies. New and additional measurement techniques are therefore needed to give a more detailed description of aerosol populations in order to establish standard procedures for measuring and regulating particulate exposure.

Here we present a procedure for sampling aerosol populations via impaction followed by automated software-based analysis using Scanning Electron Microscopy (SEM) and Scanning Transmission Electron Microscopy (STEM) coupled with Energy-Dispersive X-ray Spectroscopy (EDS). The automated analysis is capable of providing both detailed physical and chemical single particle information not provided by the current standard methods. Physical parameters such as area, diameter, and morphology is obtained, while automated EDS analysis is used to obtain elemental composition data, allowing size and morphology resolved chemical classification of each individual particle. The automated analysis is furthermore capable of systematically mapping large areas of a sample without user intervention, enabling fast and repeatable measurements, while obtaining sufficient data for statistical analysis.

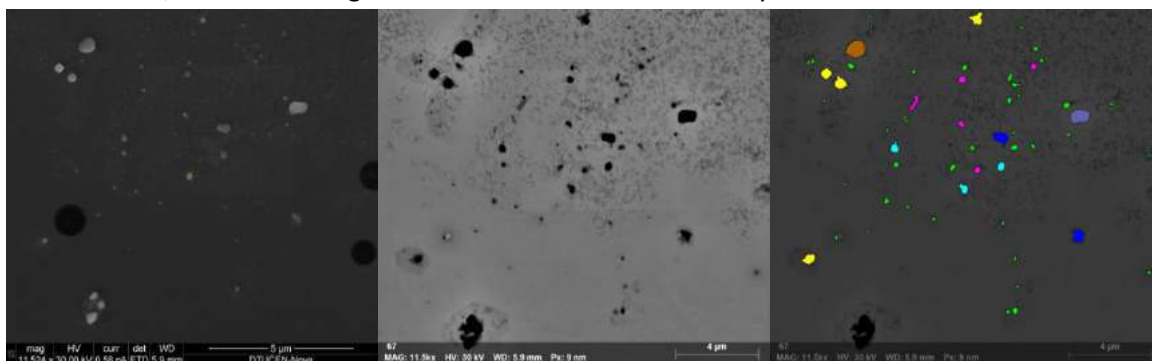


Figure 1. SEM images obtained from the automated analysis of an aerosol sample. Left: Secondary Electron (SE) image; Middle: Corresponding STEM image; Right: STEM image with particles marked for physical and elemental analysis.