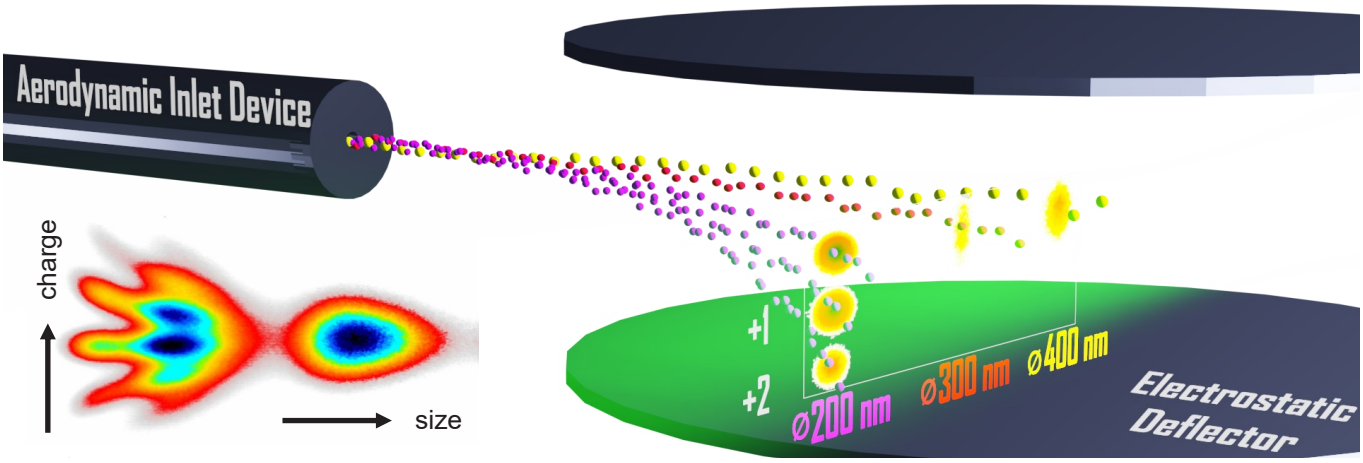
ETH zürich

Licensing Opportunity

Instrument for the simultaneous characterization of aerosol particle size and charge distributions



The particle beam is spatially separated based on size (horizontal) and charge (vertical) to form a 2D pattern that is imaged by a laser sheet. Inset: Typical experimental result that yields information on particle size and charge distributions within the same 2D image.

Application

The characterization of aerosol particle size and charge distributions is important in fields of respiratory health and airborne disease transmission. The instrument can be applied for the characterization of medical nebulizers, cough aerosols, filtration masks, as well as e-cigarettes and heated tobacco products.

Features & Benefits

- particle sizes in submicrometer range (100-1000 nm) and charge distributions
- single-charge sensitivity
- real-time measurements (<1 seconds)

Publications

- Journal of Aerosol Science 167 (2023) 106080, “Particle beam deflection imaging for simultaneous characterization of aerosol particle size and charge”, https://doi.org/10.1016/j.jaerosci.2022.106080
- Patent pending

Background

Physical properties (size and electric charge) of aerosol particles determine their spread and deposition. Significant influences of particle charge have been overlooked in the past, largely due to lack of efficient characterization methods. State-of-the-art methods provide information solely on size distributions and require long measurement times. Information of particle charge can only be obtained by serial combination of multiple devices.

Invention

The invention describes a method and a device which enables simultaneous measurement of particle size and charge distributions in real-time. First, aerosol enters a vacuum chamber through an aerosol inlet device which spatially separates particles along the horizontal axis based on their diameter. Second, particles enter an electrostatic deflector. The electric field separates particles based on their charge along the vertical axis. This forms a 2D particle beam pattern that contains independent information on size and charge distributions. Third, this pattern is imaged with a laser sheet and scattered light is recorded by a camera. Measurement times below 1 second allow for real-time characterization of unstable aerosols (such as cough aerosol) and volatile particles. A prototype was built from commercial and in-house-made parts.

transfer

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Technology Readiness Level

1 2 3 **4** 5 6 7 8 9