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1B1) (특강) FIELD EXPERIENCE OF PORTABLE SMPS+C NANO PARTICLE SIZER

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1. INTRODUCTION

This new family of portable real time SEQUENTIAL MOBILITY PARTICLE COUNTER and SIZER (SMPS+C) is designed for mobility and easy field use. An integrated battery assures hours of operation, a data logger system storage of all optioned results and a user friendly powerful software easy operation. This technology not only simplifies the SMPS operation, but it permits new on site application monitoring up to a remote wireless telephone operation.

2. INSTRUMENT

Instead of using several individual components combining to an operational system, all necessary items and appropriate functions have been combined into one portable system. This means the well known principle of Nucleus Condensation Counting was improved in such a way that:

1. the alcohol saturation chamber gets only as much moisture as needed, eliminating possible overspill and consequently contamination of the condenser and the optic,
2. the alcohol tank is integrated into the system, the level and consumption controlled and an automatic refill system assures long term operation,
3. the sample outlet air has an alcohol odor adsorber,
4. a new moisture elimination system assures long reliable field measurements, an internal heat exchange system reduces drastically the electric power consumption, permitting hours of continuous battery operation,
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Figure 1. Portable SMPS+C (Fast Sequential Mobility Particle Sizer and Counter) with the medium classifier, a climatic sensor and a mobile phone adapter.

6. an integrated air and power supply control system permits the attachment of any of our classifiers, reducing not only the overall size, but also handling and system manipulation,
7. an additional port permits the attachment of external gas and/or climatic sensors, helping a better judgement of the sampling and measurement data obtained,
8. an integrated microprocessor system permits the operation of the complete system without an attached computer, status lights and a digital display show the measurement conditions,
9. measurement, instrument and sensor data of up to ½ year can be stored on a removable data storage card,
10. The single counter and even the complete SMPS+C system can be operated remotely via a telephone modem,
11. A powerful 32 bit software makes data acquisition and analysis (including ell-known corrections, e.g. Wiedensohler and Fissan, 1988)

very practicable.

Table 1. Performance of the Particle Counter

Parameter	Range
Min. particle size in [nm]	5
Max. concentration [P/l]	10^{10}
Count Rate [P/l]	10^{7}
Sample flow rate [l/min]	0.3 or 1.5

3. COUNTING EFFICIENCY

Efficiency of the UPC 5.403, a high sensitive FCE was used as a reference counter. A cut off diameter (50% counting efficiency) of about 4.5 nm was determined, which is a good result compared to other commercial CPC. For the determination of the counting efficiency, a hot wire WoX generator was used, to generate a tungsten oxide aerosol in the size range between 1 and 15 nm (Reischl, 1997). The aerosol was then charged in a radioactive source of high activity and then classified in very short Vienna type DMA, with an effecitve length of 1.4 cm and an aerosol to sheath air ratio of Qa = 2 lpm to QSh = 25 lpm. To determine the counting.

4. STEP RESPONSE

To measure the response of the CPC to a concentration step at the aerosol inlet, a three way valve was used, to switch between filtered air and ambient air. The results showed, that the response of the instrument has an ideal behaviour for the first seconds, but for longer times a deviation could be observed. This can be described by a superposition of a second exponential decay, which can be caused through flow phenomena like eddies in the instrument.

5. SUMMARY

With the SMPS+C a new generation of field and laboratory particle counter and sizer was built up. Focused on mobility, ruggedness, stand alone operation and up-to-date compact high-tech. The application ranges from pollution and climate research, workplace and medical studies to emission investigations such as exhaust gas and filter-efficiency tests. With the fast stepping technology and the quality of the design very accurate measurements in the nano size range are possible.

REFERENCE

Reischl G.P., Mäkelä J.M., Necid J. (1997). Performance of the Vienna Type Differential Mobility Analyzer at 1.2 20 Nanometer. Aerosol Sci. Technol. 27, pp. 651 672.