



Size and number determination of nanoparticles with the Palas® U-SMPS



► The importance of nanoparticles in the environment, the medicine and at workplaces increases constantly. The U-SMPS (developed by Palas®) is a combination of the UF-CPC and DEMC and offers the users many advantages for the measurement of the size and number of submicron particles. ► **Page 2**

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From 12 to 13 September 2011 the anniversary issue of our seminar will take place in Karlsruhe with many interesting presentations around the aerosol technology. ► **Page 4**



Dear Readers,

► The year 2010 was the most successful one in the history of our company. We would like to thank our customers worldwide, giving us their confidence – and our employees, working with enthusiasm, competence and vision in the fields of service and development.

Since the foundation of the company, quality has been the highest priority at Palas®. The function, handling and life time of our products and therefore the satisfaction of our customers are always in our focus. Success proves we are doing it right: Today we are world leader in the construction of optical aerosol spectrometers and filter testing systems. Our spectrum covers eleven aerosol spectrometers, twelve dust dispersion systems, seven soot generating systems, 17 liquid nebulizers, nine dilution systems as well as eight filter or filter media test systems. In the fields of nanoparticle measurement technology and environmental monitoring further innovative products like the fine dust monitor systems Fidas®, the U-SMPS and the aerosol electrometer Charme® have been added.

We promise you: We will not rest on our success; instead we will keep up our high speed of innovation. Enjoy reading!

Leander Mölter
Managing Director of Palas® GmbH

Size and number determination of nanoparticles in practice with the Palas® U-SMPS

► The measurement of nanoparticles becomes more and more important. Not only the number of ultrafine and nanoparticles is relevant. Often also the size has to be determined accurately, for example in the case of inhalation studies, but also in environmental monitoring and workplace measurements, in filter testing or aerosol research. For the reliable determination of both values, Palas® has developed the Universal Scanning Mobility Particle Sizer.

An important application of the U-SMPS is environmental monitoring. A large number of nanoparticles exist around us, however the detection is not easy due to the small size of the particles. They may result from combustion processes in modern automotive motors, from thermal processes in industry or from house fires. When inhaled these nanoparticles go deep into the lungs where they deposit and where they can cause adverse reactions in the human body. Besides the number of particles, their size can provide first important clues concerning the responsible emitter for the measured particle concentration. Even an exact source apportionment is possible with support of additional measuring procedures. The U-SMPS offers a large benefit for workplace measurements and in the area of filter testing.

Application areas are workplace measurements and environmental monitoring, filter testing as well as medical technology

“Indoor and workplace measurements are at least as important as environmental monitoring”, explains Jürgen Spielvogel, Division Manager Environmental Monitoring and Nano Instrumentation at Palas®. In many professions, like for example the welders, the exposure to released nanoparticles is very high. The examination of the efficiency of the used filter systems can be essential for the employee as well as for the company. Thus, highly effective HEPA and ULPA filters can be tested in order to guarantee the best protection possible.

But also in medical research, the reliable determination of size and number of nanoparticles becomes more and more important because they provide a wide range of new possibilities for diagnostics and the therapy of special diseases. For example, the particles are used as contrast medium in special radiographic methods or for the treatment of certain

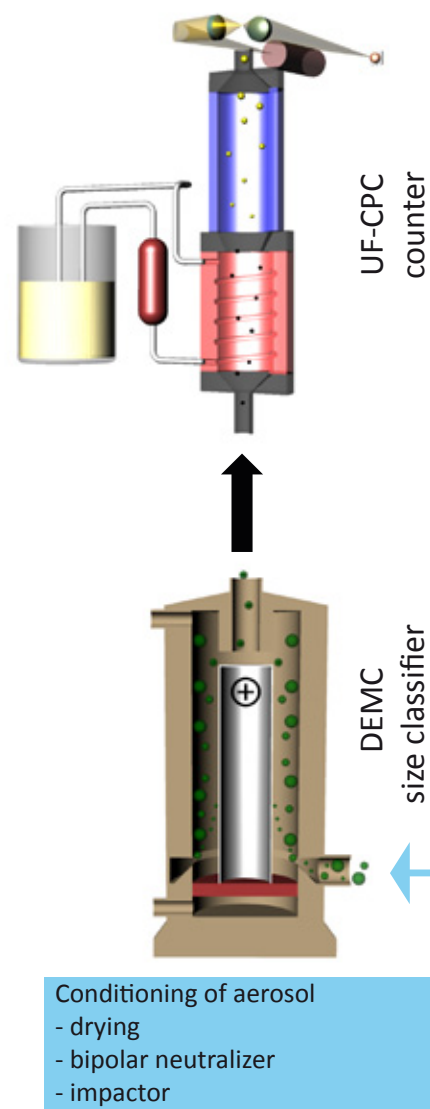
diseases like cancer. In this case, the U-SMPS can also be a valuable instrument for research and development. Jürgen Spielvogel observes the medical sector through the eyes of an expert: “I am very curious to know how the field will develop. Nanoparticles are more and more used, for example as vehicles for the transport of medical agents in the body.”

Details make all the difference

The entry into the nanoparticle technology and the realization of corresponding products were just a matter of time. “We have the background knowledge and the competence. Only the instruments were still missing”, says Jürgen Spielvogel. The development of the Universal Scanning Mobility Particle Sizer (U-SMPS) completes the nano product range of Palas®.

Great importance was devoted to details during the realization. The U-SMPS is operated via a graphical user interface with a large touchscreen. In case of the integrated UF-CPC, different working fluids can be used. The high accuracy is another advantage of the condensation particle counter. Up to one million particles per cubic centimeter can be counted in the single counting mode. CPCs of other manufacturers have to switch to a less accurate mode for these types of concentrations. Additionally, different concentration ranges can be covered by a flexible choice of sensors from the welas® system. The corresponding DEMC is characterized by an intuitive user interface. It is highly flexible by supporting and integrating existing counters and DMAs of other manufacturers. For these reasons, the new Palas® system sets a new standard in nanoparticle measurement.

► You can find further information under www.palas.de/product/particlemeasurement



Working principle of the U-SMPS with DEMC

► Particle sizes up to 64 size classes per decade are measured with the Palas® U-SMPS. The user can select any size range and the number of size channels within the thresholds and thus control the resolution and measuring time. The figure shows the working principle of the U-SMPS. For the size determination, a differential particle mobility classifier (defined in ISO 15900 as Differential Electrical Mobility Classifier (DEMC), also known

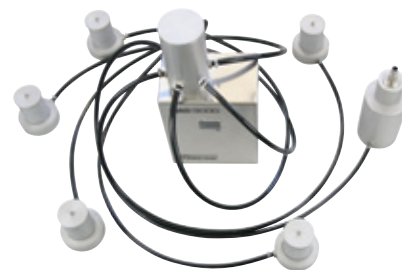
as Differential Mobility Analyzer (DMA)) is used. With this measuring device, monodisperse fractions are generated from a polydisperse aerosol. These monodisperse fractions are subsequently subjected to a counting method like the UF-CPC condensation particle counter or the Charme® aerosol electrometer. With the appropriate software, a particle size distribution is obtained.

Ready for practice: RAS 3000 and ACA 1000

Lucerne University of Applied Sciences and Arts confirms advantages of the aerosol supplying system and the clean air station for the determination of the protection degree in operating rooms.

▶ The hygienic requirements for an operating room dictate that the air inside should be kept as clean as possible. To meet the very high requirements, filter and low turbulence displacement ventilation systems are used. Their function, as well as the comparison of operating rooms are detected by determining the degree of protection according to SWKI 99-3 and DIN standard 1946-4. It is essential, that the effectiveness of the systems has to be clearly proven and that it is repeatable. For this the RAS 3000 (Reference Aerosol supplying System) and the ACA 1000 (Adjustable Clean Air station) offer special advantages. In the reference operating room of the Lucerne University of Applied

ences and Arts (Switzerland) the Palas® aerosol supplying system RAS 3000 and the clean air station ACA 1000 were tested. It could be shown that the standardized source flow Q_{REF} as well as the reference concentration C_{REF} can be adjusted locally and verified with a standard particle counter (OPC) and the respective dilution systems (VKL). It is further possible to achieve a consistent aerosol distribution at all six aerosol feeding cylinders (AAZ) using only one sampling head and one OPC. These and further advantages of the RAS 3000 and the ACA 1000 for the determination of the protection degrees one to five were confirmed in tests at the Lucerne University of Applied



RAS 3000 and ACA 1000

Sciences and Arts in comparison with the "primary aerosol supplying system".

▶ Further information and product details are available at: www.palas.de/application/cleanroomparticle

BMWi promotes DustView project of Palas® and the University of Wuppertal

▶ With support of the BMWi, the Federal Ministry of Economics and Technology, the Palas® dust measuring device DustView was further developed in cooperation with the University of Wuppertal between 2009 and 2010.

First indications about the possibilities of the DustView resulted 2008 from the project „Ein Vergleich zweier Sedimentationsverfahren zur Bestimmung des Staubungsverhaltens von Pulvern“ (topic: a comparison of two sedimentation processes for the determination of the dust behaviour of powders), (CIT, 80, No. 3, 2008, P. 343-349) by Dipl.-Ing. Sylvia Bach and Prof. Dr. Ing. habil. Eberhard Schmidt of

the University of Wuppertal. They conducted an examination on equal standards of different dust measuring devices with a standardized procedure according to DIN EN 15051. Out of curiosity, the Palas® DustView was included in the test series. The achieved results showed that health-relevant E- and A-dust fractions, which are important for the safety at work, can be determined with the basic measuring principle of the DustView. In order to further verify this attempt, another research project with the measuring device was started. This project should demonstrate the correlation of the extinction measurement with the specific characteristics of a powder as well as its particle size and the health impacts according to DIN EN 481.

Based on the previous results the DustView was modified and equipped with a second laser path. While the first laser remained in the standardized height of 13 centimeters, the second laser was mounted three centimeters above the base plate. Additionally equipped with the aerosol spectrometer welas® digital 2000 with aerosol sensor welas® 2100, light



Dipl.-Ing. Bach and Prof. Schmidt, University of Wuppertal

scattering results and time resolved extinction of the laser via different test substances (for example calcium carbonate or pyrogenic silicic acid) have been compared in five measurements per laser path. Furthermore new insights were gained about the setting properties of dust, humidity content, particle size distribution and the aerodynamic diameter. The research results offer now new applications of the modified DustView. One field of application is the quality control of bulk materials in the manufacturing industry, as for example at BASF.

Fidas® aptitude test

▶ After successfully performed preliminary tests at various locations in the past 1,5 years, an aptitude test with certification for the measurement values PM_{10} and $PM_{2.5}$ of the Fidas® fine dust measuring system is planned at TÜV Rhineland according to EN 15267 Part 1 & 2. Testing of a so called "suspended dust immission measuring device" takes up to one year and is required as proof by many measurement networks. In the context of this check, laboratory tests and an extensive field test will be performed, showing that the device under test measures reliably in comparison to reference filter samplers. Concerning the field tests, comparison measurements will be performed at different locations. According to the actual standard DIN EN 15267 there are no devices tested, which measure $PM_{2.5}$ and PM_{10} simultaneously.

▶ See also: www.qal1.de

Palas® is market leader in upgrading aerosol instrumentation in existing filter test rigs according to EN 779

▶ Palas® has become successful not only in upgrading complete filter test rigs, but also in the cooperation with partners specializing in HVAC ducting design. In the fields of air filter testing (e.g. bag filters) according to EN 779 Palas® has established itself as a reliable partner for upgrading existing filter test rigs for compliance to this standard. This includes the generation of the respective aerosol, aerosol sample taking as well as the particle measurement. Additionally, software for control systems and the evaluation of the measuring results covers the product range. Already eleven filter test rigs have been upgraded successfully to the full convenience of our customers.

Successful: Filter testing at Filtech 2011

▶ Already in 2009, when Palas® offered free filter testing during the Filtech exhibition, it was met with great interest by visitors of this event for filtration and separation technology. In order to meet the requirements of all prospective customers Palas® arrived with three additional employees at this year's Filtech. The team – consisting now of eight people – was busy throughout the entire time of the exhibition. This year, particularly the live filter tests at our three filter test systems had been again ma-

de use of. During Filtech, we could perform for our potential customers seven measurements with the MFP 3000 as well as one measurement with our test system for cleanable filter media with integrated online particle monitoring (MMTC 2000 with new Windows software). These measurements took place directly on our booth. Due to the strong demand six further tests were performed with the MFP 1000 HEPA (media test system for HEPA/ULPA filters) on the premises of Palas® following the exhibition.



▶ A short movie, taken by a professional film team on our booth, can be watched on www.palas.de/company/fact.

25th Palas® ATS – anniversary seminar

▶ All experts in the field of aerosol generation and testing should save the date of 12 and 13 September 2011. On these two days the 25th Palas® Aerosol Technology Seminar will take place in Karlsruhe. Here, science and practice will come together to discuss problems, to find solutions and to clarify user specific questions. In the Schlosshotel Karlsruhe, speakers

from universities, technical colleges and industry will give papers on current topics such as nanotechnology, fine dust, calibration of particle measurement devices, bio aerosols, filter tests and new standards.

Professor Dr. Christoph Helsper will moderate this seminar for the 25th time. During the breaks the seminar participants can catch up on the new Palas® developments. A device exhibition as well as a company tour will top this seminar off. A further highlight of the seminar will be the formal dinner including an entertaining anniversary program and allowing time for inspiring discussions. Please note, the seminar will be held in German language. Look forward together with us to our Aerosol Technology Seminar!

▶ The registration form and further information can be found on www.palas.de/display/news/9.

New employees



Judith Liebig and Karl-Heinz Weiß

▶ In accordance with the slogan „Make use of experience, when you can“ Palas® hired **Karl-Heinz Weiß** (65) as new employee. From 1970 with the professors Schönert and Rumpf up to April 2011 with professor Kasper the experienced electrical engineer has contributed significantly to the research at the Institute of Mechanical Process Engineering at the KIT (Karlsruhe Institute of Technology) by new and further developments of measuring and control electronics, especially in the fields of particle measuring technology and electronics. At Palas® he will be involved in new and further developments in the field of nanoparticle measurement technology.

Since 1 April 2011 **Judith Liebig** (31) joined the Palas® team. Her field of activity includes print marketing and the organization of exhibitions and events. The business graduate is looking forward to the new challenges in an international environment.

New sales partners

We are pleased to introduce our new sales partners:

- ▶ **Andrew Chalmers** (Filter Integrity Ltd.), situated in the northeast of England and specialized among other things in filter testing, is responsible for the distribution of the entire Palas® product range in the **United Kingdom**.
- ▶ **Tomas Prokop** (ENVItch Bohemia s.r.o.), specialized in environmental monitoring technology, is representing us in the **Czech Republic, Slovakia, Lithuania, Cyprus, Turkey** as well as in **Latvia** and **Estonia**.
- ▶ **Johan van Lieverlooy** (ENVICONTROL), specialized as well in environmental monitoring technology, is in charge of **the Netherlands** and **Belgium**.
- ▶ The contact data of all our sales partners can be found on www.palas.de/contact/reseller.

New edition: Brevier to Aerosol Technology

▶ The second, edited version of the Palas® Brevier is published. In response to many user requests the basic part concerning particle size and particle number determination as well as the part regarding nanoparticle measurement

technology and environmental monitoring have been extended significantly. Due to the larger size of 106 pages, the practical reference book is now available in a German and English version. The nominal charge is EUR 20.

▶ PALAS® AGENDA

Palas® attends regularly conferences and exhibitions. The up-to-date details can be found on our website: www.palas.de/exhibition.

We already booked a booth at the following events:

- ▶ **EAC 2011, Manchester/UK**
04. - 09.09.2011 (booth no. 10)
- ▶ **Gala 2011, Ilmenau/Germany**
06. - 08.09.2011
- ▶ **AAAR 2011, Orlando/USA**
03. - 07.10.2011 (booth no. 314)
- ▶ **Powtech 2011, Nuremberg/Germany**
11. - 13.10.2011 (booth no. 6-109)

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