



3. International ETH-Workshop on

Nanoparticle Measurement

9./10. August 1999

Proceedings can be ordered
Bundesamt für Umwelt, Wald und Landschaft
Postfach
CH-3003 Bern
Phone: 0041(31)322 93 17
Fax: 0041(31)324 01 37

The Picture:
TEM-micrographs:
Particle from Immission
Sulfer was identified by EDS-Analysis

Source: NMI Reutlingen
see Workshop Contribution No 20

Nanoparticle Emissions

Toxicity

Characterization

Abatement

Research on aerosol pollutants has lost its sheltered academic innocence. It is now the scientific basis for environmental protection and occupational health. This research has a high priority in safeguarding people at the workplace, on the street and in their homes. Aerosol technology is the critical link between toxicology/epidemiology and curtailing exhaust emissions. This new responsibility must be urgently fulfilled.

The nano-metrology researchers must deliver comprehensive data on the physico-chemical properties of the aerosol, its mobility and its ambient mutation. Consequently, the engineers must develop the emission abatement technology. And the regulatory authorities must formulate enforceable standards. The prerequisites are clear and simple definitions for the nano-particles. Moreover, the instrumentation must be cost-effective and robust, i.e. deployable in any workshop.

The inventory of the PM metrology reveals the need for systematic rethinking. The irrelevant global definition of the PM total-mass must be abandoned. Instead, specific data is required for the nano-particle properties pertaining to their mobility, concentration count, surface and chemical composition. The need for this information is generally accepted. Many are however unaware that aerosol physicists already have the theoretical basis and the measurement principles for the task. Pragmatic implementation of the available knowhow dictates the objectives. These are: describe the solutions, prevent mutual interference, simplify the methods, deduce basic units for the parameters, and standardize the calibration.

The "ETH-Workshop on Nanoparticle Measurement" has established itself as the forum for international exchange of pertinent scientific information and new technology. The 3rd Workshop in August 1999 received many contributions. We thank the authors and the participants for the open and lively discussions.

The mission is not yet completed. Numerous questions are hitherto unanswered. Several new ideas should yet be explored. We will conduct the "4th ETH-Workshop on Nanoparticle Measurement", again in Zurich, Switzerland, during the second week of August 2000.

The proceedings of the 3rd Workshop are herewith released to all interested. The proceedings are especially addressed to the regulatory authorities in Switzerland, Germany, the European Union, the USA and all other involved countries. We hope to also discuss regulatory issues in the next Workshop.

Contact Address:

Technik Thermische Maschinen TTM
Andreas C.R. Mayer
Fohrhölzlistrasse 14b
CH 5443 Niederrohrdorf
Switzerland

Phone 0041 56 496 6414

Fax 0041 56 496 6415

E-Mail ttm.a.mayer@bluewin.ch

A. Mayer, TTM
Editor

Contents

Session A: Health Effect Oriented Metrology

J. McAughey/AEA Technology Interaction of Metrology and the Assessment of Health Effects	1
H. Muhle/Fraunhofer Institute Toxic and Carcinogenic Effects of Fine Particles - Observations and Hypotheses	2
J. Heyder/GSF-IHB-Institut Are physical/chemical Properties of Nanoparticles relevant for Biological Effects?	3
M. O. Constantini/Health Effects Institute Particle Emissions Characterization and Health Effects Research	4
P. Straehl/Swiss Agency for the Environment, Forests and Landscape Health Effects of fine Particles - Immediate Action Imperative?	5

Session B: Instrumentation and Calibration

M. Maricq, Dick Chase, Diane Podsiadlik/Scientific Research Laboratory Comparing ELPI and SMPS Measurements of Motor Vehicle Exhaust PM	6
Ch. Barnes/Perkins Engines Co Ltd The Sensitivity and Repeatability of Nanoparticle Measurements at High Dilution Ratios	7
J. Tikkanen/Dekati Ltd. ELPI in Automotive Exhaust Measurement	8
B. Wende, M. Türk, K. Schaber/Universität Karlsruhe Online Particle Measurement under Industrial conditions with the three Wavelengths Extinction Method	9
P. Müschenborn, A. Trampe, J. Luo, F. Otten, S. Neumann, H. Fissan Universität Duisburg Development of a new wide-range Differential Mobility Particle Sizer (DMPS)	10
M. Kasper/Matter Engineering NanoMet: online Characterization of Nanoparticle Size and Composition	11
C.-D. Schegk/VerAn Particle Size Classification by Means of Particle Centrifuge and Diffusion Battery	12
Lianpeng Jing/EAM Standard Combustion Aerosol Generator (SCAG) for Calibration Purposes	13

J. Schlatter/EAM From Generation of Combustion Aerosols to Reference Materials	14
D. Kittelson/University of Minnesota Influence of Sampling and Dilution Conditions on Nanoparticle Measurements	15

Session C: Field Measurements

J. Shi, R.M. Harrison/University of Birmingham Source and Concentrations of ultrafine Particles of < 10 nm in the Urban Atmosphere	16
C. Dickens/AEA Technology Possible Approaches to Incorporating fine Particle Parameters into Vehicle type approval Legislation	17
O. Wilhelm, B. Keller, H.C. Siegmann/ETHZ Exposure to Combustion Aerosols in Buildings - or how to make use of the Air Pollution	18
N. Künzli, P. Mathys, L. Oglesby, W.B. Stern, Ch. Braun, C. Monn, M. Jantunen/ Institute of Social and Preventive Medicine University Basel, Institute for Mineralogy and Petrography University of Basel, ETHZ, KTL Kuopio Traffic related PM _{2.5} efficiently penetrate from outdoor to indoor	19
W. Dreher, W. Nisch Tarek Lutz, N. Kern/Universität Tübingen Nanoparticle analysis of Traffic Immission	20

Session D: Nanoparticle Emissions from Various Sources

V. Schmatloch, EMPA Fine Particle Emissions of small wood fired Furnaces	21
K. Bengtsson/ABB Particulate Emissions by Gas Turbine Combustion	22
U. Wieser/Oekozentrum Langenbruck New Ways in Nanoparticle Reduction in Combustion Processes	23
W. Koch, O. Pohlmann/Fraunhofer-Institut Characterization of Nanoparticles from Different Sources: Diesel Engines, Welding Fumes, Environment, Chemical Reactions	24
Ch. Rigau, O. Belot/PSA Peugeot Citroën Influence of Fuel Sulphur on the Formation of ultrafine Particulates in Diesel	25

Session E: Basic Properties of Nanoparticles

A. Kelter, K. Siegmann, H.C. Siegmann/ETHZ Evaluation of the Surface Properties of Nanoparticles	26
H. Burtscher/Fachhochschule Aargau Particle Formation due to Fuel Additives	27
I.A. Khalek/Southwest Research Institute Nanoparticle Growth During Dilution and Cooling of Diesel Exhaust: Experimental Investigation and Theoretical Assessment	28
E. Weingartner, S. Nyeki, S. Henning, U. Baltensperger/PSI Hygroscopic Properties of Aerosol Particles in the Temperature Range - 11°C < T < 20°C	29
M. Ammann, F. Arens, U. Baltensperger/PSI Nanoparticles - Chemical Facts and Artefacts: Effect of Sampling Procedures on Chemical Parameters of Soot Particles	30
O. Basile, A. D'Atessio, P. Minutolo, L.A. Sgro/Università Napoli Characterization of Nanoparticles in Premixed Flames by UV Scattering, Absorption and Fluorescence	31

Session F: After-treatment

C. van Gulijk, M. Makkee, J.A. Moulijn/Delft University of Technology The Turbulent Precipitator for Diesel Exhaust Filtering	32
C.M. Fleck/Atom Institute of the Austrian Universities An Electrical Soot Trap for so/d and condensed Nanoparticles with a continuous electrochemical Conversion of Soot and Hydrocarbons	33
U. Matter/ETHZ Formation of Volatile Particles in Traps	34
A. Mayer/UM Trapping Efficiency for solid Particles ... and the Volatiles?	35
A. Feest, A. Smith, C. Dickens, O. Blaikley/AEA Technology Influence of Catalysts and of O11 Consumption on Particulate Emissions	36
J. Lemaire/Rhodia What are the Ultimate Limits of Integrated Emission Controls Strategies?	37

Session G: Emissions of Internal Combustion Engines

N. Collings/University Cambridge The Effect to Automotive Tailpipe Geometry on Nano-particle Generation - /n/tia/ Results	38
J. Czerwinski/Biel School of Engineering and Architecture Nanoparticles in the Exhaust Gas of all IC-Engines?	39
O. Rickeard, Y. Kwon, J. Bateman/ESSO What Causes High Particle Emissions from Gasoline Vehicles? A Study of Vehicle Effects	40
O. Lepperhoff, A. Pungs, B. Lüers/FEV New Insights into In-cylinder Particle Size Distribution changes during a Diesel Engine Combustion Process	41
R. Vogt/Ford Forschungszentrum Comparison of Tailpipe and Dilution Tunnel Measurements	42
N. Metz, O. Resch, F. Steinparzer/BMW Characterization of Particulate Matter Emission of Modern Diesel Passenger Cars	43
Th. Lanni/NCS DEC Current Particulate Matter Emissions Research at the New York State Department of Environmental Conservation	44
M. Gautam, A. Bugarski, S. Mehta, R. Byers/WVU Particle Size Distribution from Heavy Duty Diesel and Natural Gas Vehicles	45
P. Herzog/AVL Particles from Direct Injection /C-Engines	46

APPENDIX

▪ Program of the 3. ETH Workshop on Nanoparticle Measurement	1
▪ List of Participants	2
▪ E-Network of Metrology Experts	3
▪ Questionnaire Results	4

to the beginning

