



## Association for Organizing the ETH-Conference on Combustion Generated Nanoparticles

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# Report on the 22<sup>nd</sup> ETH Nanoparticles Conference

June 18<sup>th</sup> to 21<sup>st</sup> 2018

[www.nanoparticles.ethz.ch](http://www.nanoparticles.ethz.ch)

Again, this year's ETH Conference on Combustion Generated Nanoparticles turned out as success and brought satisfaction to participants, local and international from far abroad; they all experienced also a sunny City of Zurich all the week long.

**Number survey:** Close to 400 participants appeared, they came from 35 countries, filling the lecture room almost to its capacity; first time attendants constituted about one third, while 38% came from the local area. In view of many young researchers average age is astoundingly low.

In plenary sessions new results from 10 different, however related, disciplines were presented within 50 topics. On top of that, there was a poster exhibition with 70 impressive posters, being discussed and scrutinised in three extensive sessions. Now our conference library contains more than 2000 documents, which are online available, being available in several renowned public libraries marked by means of ISBN 978-3-033-06722. Basically, conference topics reflect somehow public actuality:

- Ambient Air
- Fundamentals
- Aircraft and Airports
- Non-Road Sources
- Emission Control of Diesel and Gasoline Engines
- Particle Filters
- Biomass
- Health
- Particle Metrology and Chemical Characterization
- Emission of In-Use Vehicles

The importance of health impacts, two sessions, is increasing year by year: neuro-toxic questions for instance, causal connections to Parkinson and/or Alzheimer appear on top of evidence of cardiovascular, cerebrovascular mortality and carcinogenicity. Intentional defeat measures for emission reduction equipment, particle-filters and DeNOx-catalysts are a highly explosive topic, regardless of the originator, may it be operator or manufacturer; this was the third day's topic called Focus Event.

Press coverage by daily papers is rather poor; apparently, in editorial committees scientific and technical knowledge is lacking for understanding basics such that risks can be recognised early, while on the other hand professional publications, car manufacturer oriented, tend to suppress health effects of emissions, which is quite unfortunate.

In 1997 the ETH-NPC had been started as a one-day interdisciplinary workshop of 26 expert participants, in order to discuss urgent topics of development and evaluation of particle filters. Particle filter retrofit of construction equipment constituted serious problems, crucial for granting construction licence of the NEAT-tunnelling project from viewpoint of workmen's occupational health; elimination of alveolus penetrating solid particles had been given priority. Nowadays, this meeting is the centre of responsibly thinking scientists and engineers concerning harmful substances from combustion, their generation, measurement and their elimination

The special character of this conference is incomparable to any other one, an academic conference transgressing disciplines, completely free of commercial interests focused on the elimination of harmful substances. The conference is representing the responsibility of science and technology for society looking forward with the aim of guiding public measures in the sense of promoting best available technology without being impeded by existing sometimes narrow minded legal views. Despite being basically pragmatic, there is no deviation from strictness of science.

Being free of charge for participants the conference constitutes an outstanding example of Swiss hospitality embedded into the architecture of the renowned Federal Polytechnic Institute's main building.

In an impressive opening address, the **Hon. Tiana Angelina Moser MP** underlined the importance of this conference: strictness of logic and inspiration guided by emotion form a symbiotic connection which is important for public life, called politics. – this symbiosis has been formulated already in a remarkable account by Rudolf Diesel in 1913 “...*science is a tool, creation is reserved to intuition*”.

Key lecture was presented by the eminent senior of biophysics, **Wolfgang Kreyling, professor em., Helmholtz Institute, Germany**. He emphasized professional enrichment due to interdisciplinary interchange of the conference as experienced by himself.

At the FOCUS event, **Mr Peeters Weem, Government of The Netherlands**, reported on New Periodic Control: The Netherlands have already realized the essence of this conference since beginning: this is the particle counting criterion, in order to make sure the functionality of filters (elimination > 99%).

**Nino Künzli, Chairman, Swiss Commission for Clean Air**, eminent scholar of epidemiology, professor University of Basle, explicitly stated that the interdisciplinary approach is the only way and prerequisite for articulating legal documents may they be ordinances or decrees.

**V. Hosseini, EPA Teheran, professor at Sharif University**, explained how findings at this conference were transferred into environmental policies of Iran; now, regulations there are the same as in Switzerland, more than 10'000 filters are in operation. Similar news had come earlier from Israel, China, Chile and Columbia; lately, there has come similar report from Mexico city, the first using particle number counting on petrol engines in 60 PTI stations.

It is beyond means and framework here to provide a short summary of the abundance of information as presented, not to mention the trap of selectivity. Obviously, on many places of research the spark has “fired”, research goes into depth, causing a call for even “more research is needed”. Fortunately, engineers never waited for an end; they are used to develop functional and cost adequate solutions based on respectively safe knowledge of the time.

#### This year's highlights

- Nowadays, all new diesel engines are fitted with highly efficient filters and DeNOx equipment; compared to 1990 emission of nanoparticles has been reduced by one over thousand, nitrogen-oxides by one over a hundred. This relates to about 100 million vehicles on European roads – solely thanks to this conference's principle: ultrafine particles are to be counted (determined by number in contrast to determination by mass – note: this principle has not yet reached the USA).
- In Europe, since 2017, new gasoline engines with direct injection have to be equipped with particle filters as well as off-road engines for instance in construction, agriculture, forestry and inland waterways.
- The importance of solid ultrafine particles has been recognized: On top of the first order effect (tininess permitting cell penetration), there is the Trojan horse effect: due to the tremendous surface/mass ratio (200 m<sup>2</sup>/g) carcinogenic substances, like PAH and metal-oxides may be transported too. There is evidence that in the total organism cells and DNA are subject to effects and there may be even an epigenetic threat.
- The schizophrenic character of the present public debate to devilish the diesel engine has been brought up, in particular a skew view of limit concentrations, which overvalue NO<sub>2</sub> and undervalue nanoparticles by far.
- Particles from aircraft propulsion have been recognized and measured. Thanks to a Swiss initiative of the Federal Office for Civil Aviation) in cooperation with EMPA, the national laboratory for materials research a novel certification has been introduced by IATA.
- Finally, particle emissions from ocean going boats have made it into the focus of attention; there was information telling the whole Mediterranean Sea to be declared as a low emission zone.
- Securing quality of emission reduction devices of in-use vehicles Euro 6/VI has to have top priority as has been pointed out at the Focus-Event; The Netherlands do everything to accelerate measures for achieving that aim, while in Switzerland the parliamentary motion Moser is aiming for it; B. Gloor, official of AWEL Zürich detected 10% of defect devices.

Our thanks go also to the catering SV, organiser for both, refreshments during recess and the conference dinner. In course of 21 years we have learned, that some extended breaks are needed, to improve communication in particular if delicacies and coffee are available and making participants forget that they are overcoming three storeys when looking at exhibits or posters. As usual, the exhibition of measuring instruments and of particle filters and of posters brought about many dialogues and discussions, sometimes quite noisy. Swiss bells for cattle herding were successful in finishing breaks.

Authors agree to have their publication for unlimited time on the home page of this conference; download is feasible at any time; hence, via [www.nanoparticles.ethz.ch](http://www.nanoparticles.ethz.ch) an electronic library of more than 2000 scientific papers, navigable by key words is available. On this web-site one may find a photo-series and this year for the first time even a video to catch the atmosphere for those who could not participate.

All conference-contributions are also collected on a CD for which there exists an increasing demand by public libraries of rank. These CDs carry an ISBN number; hence, contribution can be quoted in refereed publications. On top of that, the Springer Journal "Emission Control Science and Technology" offer to the authors publication as full paper after a peer review.

4 Rewards have been sponsored:

- There were three prizes for best posters (600, 400, 200 CHF) sponsored by Dr. O. Brändli; they went to Franz Friebel, ETH, for his contribution regarding ozone generation, to Michaela Ess, METAS for characterising a novel MiniCAST and to Dominic Their, NGK, for optimising particle filters of gasoline engines.
- The Trojan horse prize for excellent contribution regarding toxicity (2000 CHF) sponsored by Dr. J. Schiltknecht went to Maria Muñoz, EMPA, for her investigations into PAH-layers on nano-particles, which are neuro-toxic; they have been observed in higher concentrations in gasoline exhaust than in Diesel exhaust.

Participation at ETH-NPC is free of charge; this way keeping the reputation of being a purely academic event, thanks to the generosity of ETH and Swiss authorities. Aimed is for as many as possible of young scientists and engineers as attendants, to keep the conference young; PhD-students of today will be decision makers within a few years. Nevertheless, experienced, almost "old age" guys are needed for keeping continuity; as well the mixture is part of the game, not only of disciplines of different branches of society and economy as well, - even the automotive industry was represented (13 companies, albeit not too active).

#### **Why more conferences, aren't 22 enough?**

Thanks to this group of experts (interdisciplinary about 2600 scientists, engineers, officials) argumentation has been brought forward to substantiate the need for the particle counting criterion of nowadays legal homologation of vehicles in Europe; 100 million highly efficient filters are now on European roads. There remain still important tasks to be performed, even if we continue to concentrate on solid particles: their generation, biologic effects, technical means for elimination, legal ordinances for enforcement for all kind of thermal engines of power conversion – in addition to new diesel engines, also gasoline engines, aircraft propulsion, locomotives and riverboats and ocean shipping require our attention.

Many of these tasks are important for human health, they ought to be treated with priority. Unfortunately, environmental policies are still rarely governed by rational calculus, much more by a sort of "public mood" of the day. We may remind, that already in 1775 P. Pott recognized soot from combustion causing cancer; However, it took to 2012 for WHO to declare soot of combustion engines being carcinogen class1 (like asbestos) and even not one single public authority in any country has reacted so far by setting new limits!

As there is still plenty to do, we invite to the 23<sup>rd</sup> ETH Nanoparticle Conference to take place in the Main Building of the Federal Polytechnic Institute, Zurich on June 17<sup>th</sup> to 20<sup>th</sup> 2019 – safe the date!

**Last but not least:** Only, thanks to many supporters and supporting institutions, public authorities, private persons and companies, altogether 34 of them plus 19 exhibitors, we were enabled to tackle this enormous task; many thanks to all of them!

July 7<sup>th</sup>, 2018  
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