Next Generation of Particle Number Instruments for Vehicle Type Approval and Quality Control of DPF Kerbside
Luis Cachón, Stefan Gerkens

INTRODUCTION and MOTIVATION
The latest news regarding Real Driving Emissions RDE for LDV are likely to have a great impact on policy maker decisions, development in the automotive industry and testing procedure for research and control organizations in general.
This study presents through several application examples of the current and next generation of particle number instruments for vehicle type approval and quality control of DPF Kerbside.
This latest portable nanoparticle instrumentation based on diffusion charging enables a new measuring procedure in automotive application to measure number concentration and diameter of nanometer sized particles in the size range 10 – 500 nm. Diffusion charging technology has been already satisfactorily proved for personal exposure monitors. Since its measuring principle uses electrical charging to count particles, not only it enhances the quality of the global measurement, but also the cost of acquisition and tests per test are significant lower. The instrumentation is compact, easily portable and provides on-line response. Due to these properties it is a suitable technology for particle number concentration measurements in non-laboratory settings. It is battery operated and therefore appropriate for on-board and field measurements.

CURRENT LEGISLATION ON PARTICLE EMISSIONS
- UNECE R83 → Euro 6 for LDV (Diesel since 2011, GDI from 2017)
- UNECE R49 → Euro VI HDV

testo VIPR + CPC: PMP compliant measurement technology for chassis dyno
- Type approval UNECE R83 and R49
- RBD of diesel and gasoline engines
- RBD of diesel particle filter (DPF)
- Particle counting at chassis dyno and/or test bed.

ONCOMING LEGISLATION ON PARTICLE EMISSIONS
- RDE for LDV according to regulation 459/2012
- In-Service Conformity HDV according to regulation 64/2012
- Stage V Regulation for NRMA according to COM(2014) 581

testo NanoMet3: PEMS-PN compliant technology for on-board measurements
- Type approval RDE
- In-Service Conformity HDV
- RBD of diesel and gasoline engines
- RBD of diesel particle filter (DPF).
- Swiss legislation 941.242 on portable particle counters for construction machinery

testo PEMP: Portable Emission Particle Analyzer for periodic technical inspection
- Periodic technical inspection in compliance with regulation SR 941.242
- In-Service Monitoring of NRMA according to COM(2014) 581

EXPERIMENTAL RESULTS

- PEMS-PN application #1
JRC Inter Laboratory Comparison Exercise of the PEMS-PN measurement technology on behalf of the European Commission.

- PEMS-PN application #2
Periodic technical inspection in Switzerland
Street Sweeper Citycat 2020 Diesel after DPF

testo NanoMet3 Particle Number [#/cm³]
Low idle   ≈ 1.1E7 #/cm³
High idle   ≈ 1.5E7 #/cm³
Free acceleration

- PEMS-PN application #3
DPF Retrofit project in in Colombia, Santiago de Chile, China, Iran, Israel, Mexico...
MAN SoloBus Diesel EURO III before and after DPF

- PEMS-PN application #4
Detection of defective DPF
Peugeot Partner Diesel with defective DPF

CONCLUSIONS
Portable nanoparticle instrumentation based on diffusion charging constitutes a new measuring procedure in automotive application to measure number concentration and diameter of nanometer sized particles in the size range 10 – 500 nm. Since its measuring principle uses electrical charging to count particles, not only it enhances the quality of the global measurement, but also the cost of acquisition and costs per test are significant lower. The instrumentation is compact, easily portable and provides on-line response. Due to these properties it is a suitable technology for particle number concentration measurements in non-laboratory settings.

CONTACT
Luis Cachón
E-mail: sales-nanoparticle@.de
Phone: +49 7653 681 5062

Testo AG • Testo-Strasse 1, 79853 Lenzkirch, Germany
www.testo-particle.com