8.VERT-Forum – 17.March 2017, EMPA-Academy Dübendorf

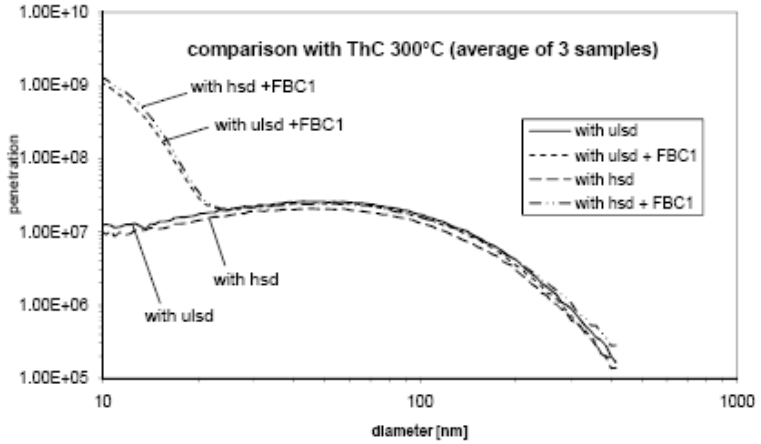
SINO Swiss DPF-Technology Transfer via Pilot Fleets and Bench Tests

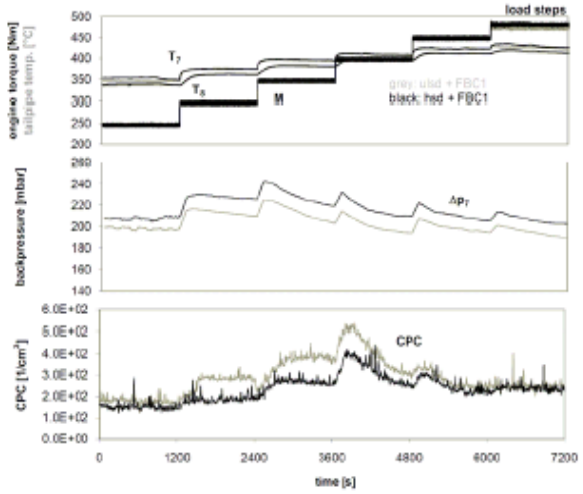
DEZA-VECC-VERT-Cooperation Project
2011-2015 - and follow up
a very challenging successful project

A.Mayer

find Sulfur tolerant DPF

- 9 VERT certified DPF tested with fuel sulfur 1200 ppm
  7 fuel sulfur tolerant: mainly FBC and TM systemes





SAE 2011-01-0605

DPF Systems for High Sulfur Fuels

A.Mayer, J.Mooney
TTM, Switzerland, LLC, USA

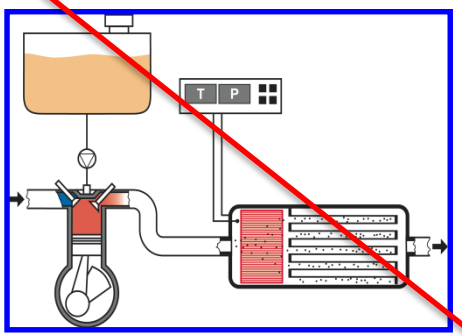
J. Czerwinski, P.Bonsack
AFHB, Switzerland

L. Karvonen
EMPA, Switzerland

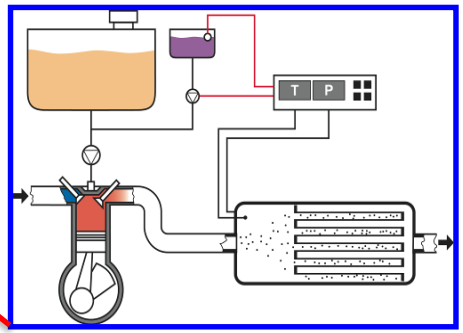
Liu Xian
VEMC Beijing

DPF-Technology is possible and very efficient even at very high fuel sulfur content

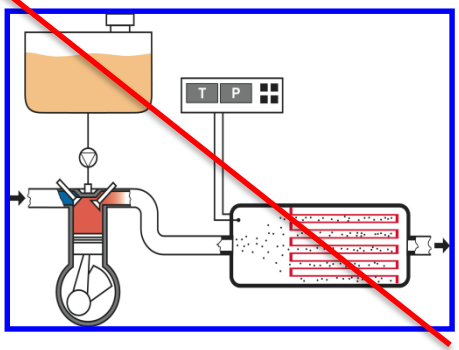
Adaquate Filter Systems are available



CRT >260°C

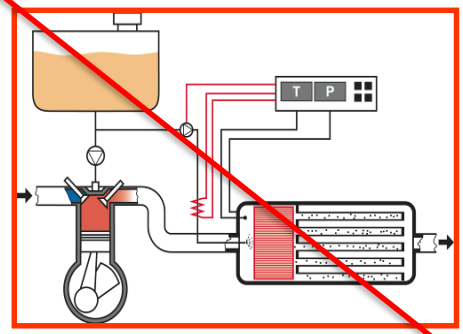


FBC >340°C

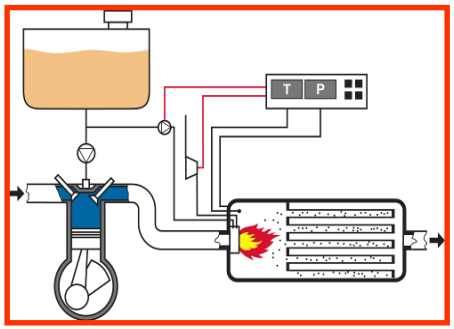


CAT Coating > 240 °C

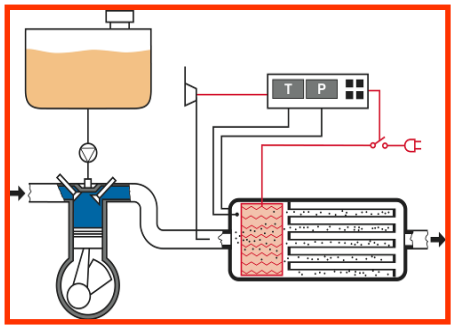
Passive Filters



Cat.Burner > 260 °C

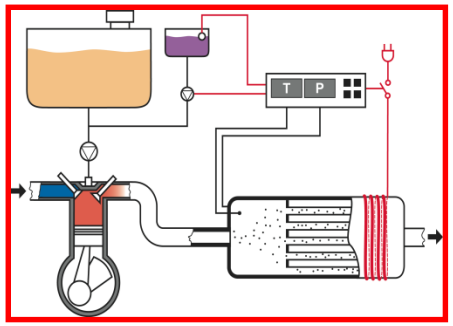


Burner ambient

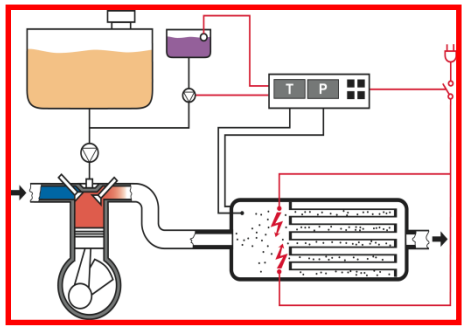


Electr.Heater ambient

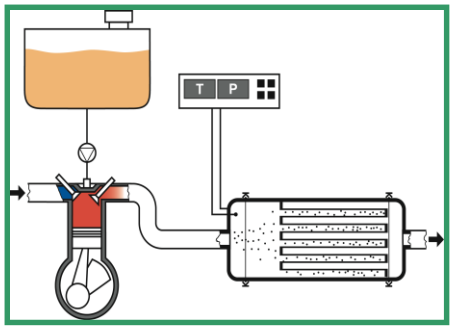
Active Filters



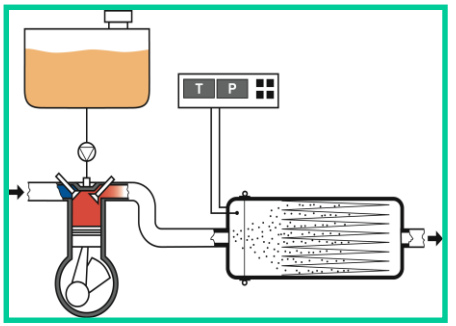
FBC active > 250 °C



FBC active > 200 °C



Offline Regeneration



Disposable Element

Selection of Filter Systems and establish Project Partnership

DINEX:

- passive: SiC coating (>240 °C) or FBC (>350 °C)
- active: SIC HC-dosing / >220°C)

PURItech:

- passive: SiC-CCRT (> 250 C)
- active: DAS coated (>190 °C)

HJS:

- passive: SMF-CRT (> 240 °C)
- active:SMF-AR any temperature

Filter-Testing in 3 large Laboratories and with Beijing University BIT

Instrument Donations

- Matter NanoMet 3
- Testo 350
- CPK-GSM/GPS Dataloggers

Engine Laboratories

- VETC / Xiamen
- JNATC / Jinan
- VEMC / Beijing

Field Measurement Training with PN-Insturuments

- BIT – Prof.Ge

Pilot Fleets in 3 Chinese Megacities for two years

Nanjing:

- 10 Coaches – all passed the test
- Mileage > 2 Mio km

Xiamen:

- 10 city buses - all passed the test
- Extremely low load operation

Beijing:

- 8 construction machines – 2 ridiculous failures
- A challenge of its own

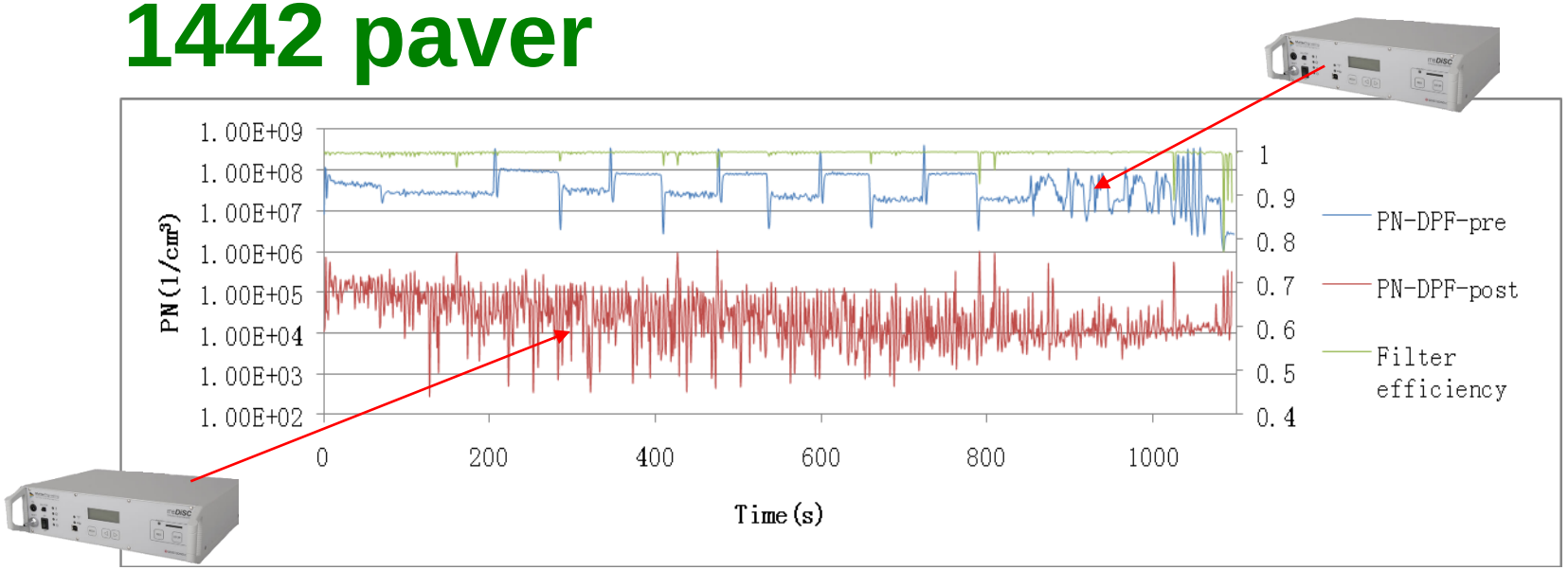
南京改造车辆
Transformed Vehicles in Nanjing

厦门实验车辆
Test Vehicle in Xiamen

北京市非道路改造
Non-road Transformation in Beijing

BIT: with 2 instruments simultaneously

1442 paver



- DPF前颗粒物数量平均浓度：4.93E+07/cm³
  Average Particulate Number Concentration before DPF: 4.93E+07/cm³
- DPF后颗粒物数量平均浓度：5.35E+04/cm³
  Average Particulate Number Concentration after DPF: 5.35E+04/cm³
- DPF平均过滤效率：99.76%
  Average Filtration Efficiency of DPF: 99.76%
- 第一次测试DPF平均过滤效率为99.62%，第二次效率比第一次实验高0.15%

The Average Filtration Efficiency of DPF in the first test is 99.62%, and the final test is 0.15% higher than the first test.

Emission Measurements by BIT

Test Results Nanjing / PN-Efficiency from Reports BIT

Vehicle	1 A34568 DINEX	2 A31695 DINEX	3 A32292 DINEX	4 A33377 DINEX	5 A33751 DINEX	6 A33694 Puritech	7 A33742 Puritech	8 A33753 Puritech	9 A33755 Puritech	10 A39358 Puritech
1 - Dyno	99.91	99.94	-	99.91	90.39	-	91.45	-	99.45	99.86
1 - Road	99.96	99.38	99.94	99.92	86.00	99.81	97.76	-	99.95	99.15
2 - Dyno	58.43	69.65	99.35	97.12	96.93	79.48	83.01	97.82	95.56	95.72
2 - Road	99.78	48.83	99.11	82.85	93.22	21.85	63.01	99.14	97.44	79.20

Measurement with 2 NanoMet3 in parallel
Measurement 1: August 2014 after 3-4 weeks of installation
Measurement 2: January 2015 after about 100'000 km of operation

Test Results Xiamen / PN-Efficiency from Reports BIT

Vehicle	1 D59281 DINEX	2 D59289 DINEX	3 D59293 DINEX	4 D88987 DINEX	5 D88957 DINEX	6 D89330 Puritech	7 D89331 Puritech	8 D89336 Puritech	9 D59290 Puritech	10 D59283 Puritech
1 - Dyno	98.76	99.50	99.08	98.85	96.96	97.20	98.67	97.42	94.17	91.03
1 - Road	99.20	99.82	98.34	97.65	99.54	98.06	98.47	98.97	96.76	-
2 - Dyno	94.98	98.20	85.92	91.11	94.75	99.14	95.60	93.91	93.72	77.93
2 - Road	99.55	99.78	97.92	80.92	94.05	99.91	99.57	99.24	95.02	62.48

Test Results Beijing Construction / PN-Efficiency from Reports BIT

Vehicle	1 DL1385 HJS active	2 DL1404 HJS active	3 DL1410 Puritech passive	4 DL1406 Puritech passive	5 DL1442 Puritech passive	6 DL1434 Puritech passive	7 DL1435 Puritech
1 - Dyno	-	-	-	-	-	-	-
1 - Road	-	-	-	-	-	-	-
2 - Dyno	-	-	-	-	-	-	-
2 - Road	99.72	97.07	99.88	95.09	99.10	99.25	no data

Measurement with 2 NanoMet3 in parallel
Measurement 1: not performed
Measurement 2: March 2015 after 2-3 month of operation
Machine with DL 1435 was transferred to outside Beijing at very high sulfur content; not measured

VIDEO

DECA-VECC-VERT Cooperation Project

Dr.Liyan WANG, DEZA China

China-VERT follow up after closing-event Oct.2015

- China asks for continuation to support the Shenzhen project
  Swiss DEZA needs evaluation and new planning – still ongoing
  → VERT should publish a comprehensive report on this project
- CATARC visits VERT on 18.Dec.2015 asking for cooperation
  China Automotive Technology and Research Center (CATARC) and CVEC (Emission Control)
- CAAC-ICCS visits VERT on 22.April 2016 asking for Cooperation and Support
  Clean Air Alliance for China – Innovation Center for Clean Air Solutions (US)
- 2015: Corning (30'000), Pirelli (10'000), Baumot very active in China
- 3 Chinese Filter companies ask for selling DPF in Tehran
- 2 Chinese Filter Substrates VERT certified
- 2 more Chinese Filter companies negotiate VERT certification
  → to include 4WC and GPF
- OE require VERT-certificate from Filter manufacturer
- VETC becomes VERT-Inspector for endurance test in China
- VECC will present further steps in upcoming ETH-NPC June 2017