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 systems

SAE 2011-01-0605

DPF Systems for High Sulfur Fuels

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

J. Czerwinski, P. Bousack
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

Passive Filters

CRT >260°C
FBC >340°C
CAT Coating > 240 °C

Active Filters

Cat.Burner > 260 °C
Burner ambient
Electr.Heater ambient

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)

**PURIttech:**
- 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-Instruments
- 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

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>A34568 DINEX</th>
<th>A31695 DINEX</th>
<th>A32292 DINEX</th>
<th>A33377 DINEX</th>
<th>A33751 DINEX</th>
<th>A33694 Puritech</th>
<th>A33742 Puritech</th>
<th>A33753 Puritech</th>
<th>A33755 Puritech</th>
<th>A33058 Puritech</th>
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<tbody>
<tr>
<td>1 - Road</td>
<td>99.96</td>
<td>99.38</td>
<td>99.94</td>
<td>99.52</td>
<td>96.00</td>
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<td>97.76</td>
<td>99.95</td>
<td>99.15</td>
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<tr>
<td>2 - Dyno</td>
<td>58.43</td>
<td>69.65</td>
<td>99.35</td>
<td>97.12</td>
<td>96.93</td>
<td>79.48</td>
<td>83.01</td>
<td>97.62</td>
<td>95.56</td>
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<tr>
<td>2 - Road</td>
<td>99.78</td>
<td>48.83</td>
<td>99.11</td>
<td>82.86</td>
<td>93.22</td>
<td>21.85</td>
<td>63.01</td>
<td>99.14</td>
<td>97.44</td>
<td>79.20</td>
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</table>

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

<table>
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<tr>
<th>Vehicle</th>
<th>D59281 DINEX</th>
<th>D59288 DINEX</th>
<th>D59289 DINEX</th>
<th>D59290 DINEX</th>
<th>D59291 DINEX</th>
<th>D59292 DINEX</th>
<th>D59293 DINEX</th>
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<td>96.96</td>
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<td>97.42</td>
<td>94.17</td>
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<tr>
<td>1 - Road</td>
<td>99.20</td>
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<td>97.66</td>
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## Test Results Beijing Construction / PN-Efficiency from Reports BIT

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<tbody>
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<td>1 - Dyno</td>
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<tr>
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<td>99.88</td>
<td>95.09</td>
<td>99.10</td>
<td>99.25</td>
<td>no data</td>
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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