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OSTBAYERISCHE TECHNISCHE HOCHSCHULE REGENSBURG
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Problems with synthetic soot loading for the development of Gasoline Particulate Filter (GPF) load sensors

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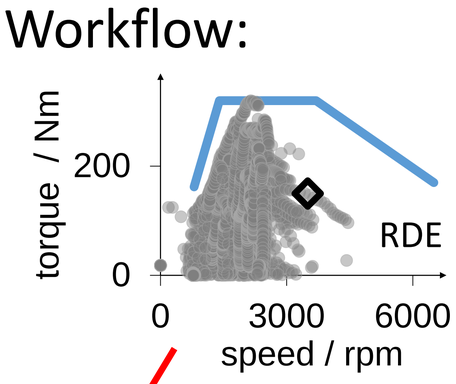
Introduction & Background:

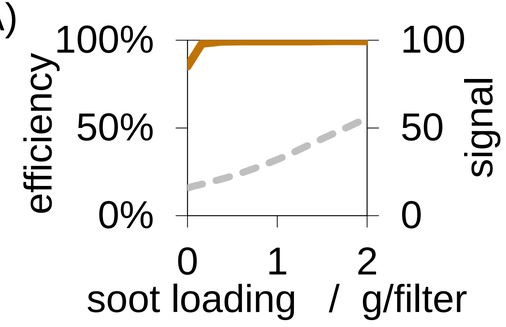
- The Particle Number (PN)-limit of $9 \cdot 10^{11} \frac{\#}{km}$ (Real Driving Emission) according to (EU) 2016/427 (EU 6d TEMP) and future EU7 regulations make GPF´s essential [1]
- Future required GPF monitoring will be a challenge
- Hot conditions of the exhaust → no sensor technology would be actually required for monitoring (state of health and the current loading status)

Methodology:

Workflow:



DoE (SOI, FUP, λ) [3]



[2018 -2020]

Project: „Load Sensor for GPF“

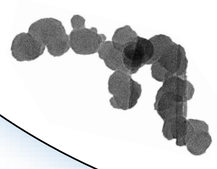
Resistive- PM

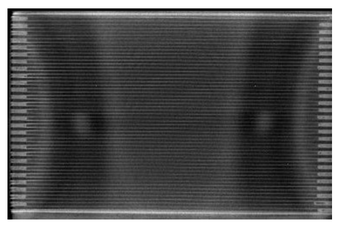
Electrostatic- PM

Radio-frequency

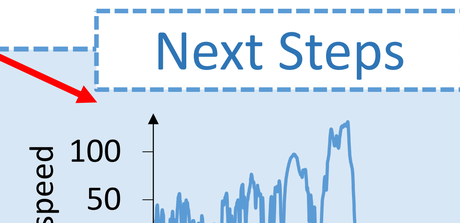
Pressure

Differential pressure

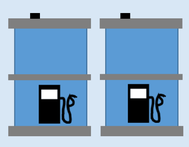




„Exhaust system“

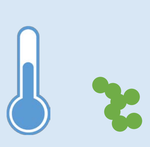


Next Steps



different fuel qualitys

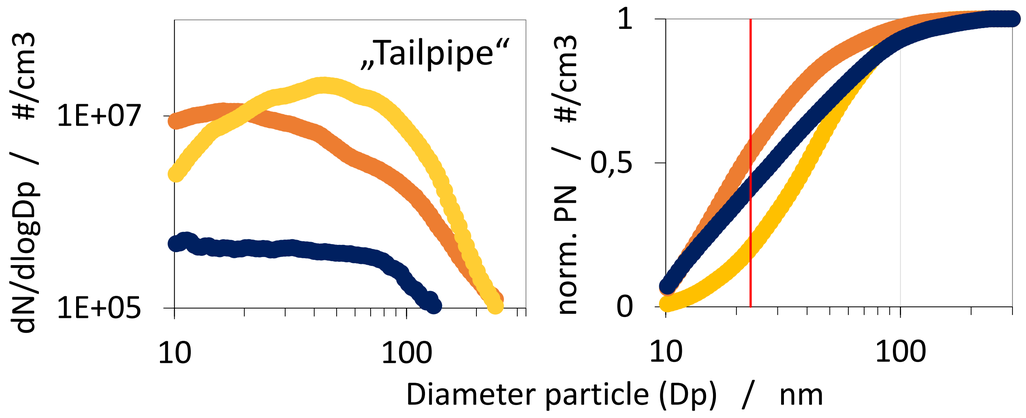
GPF failure



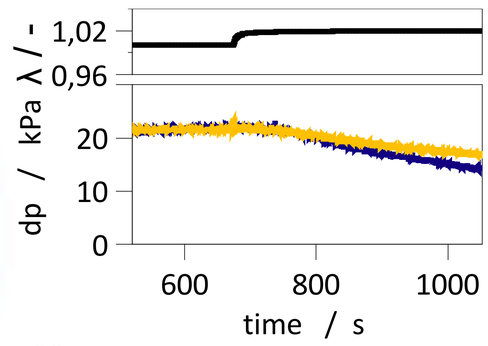
cold start , ash & Printex U

transient

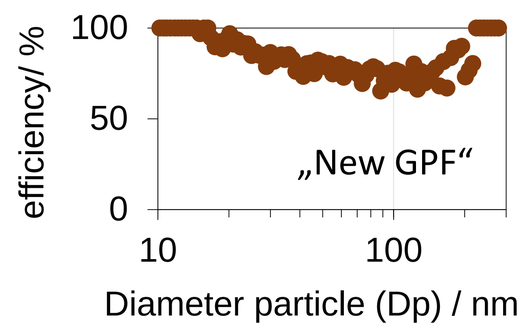
Results:

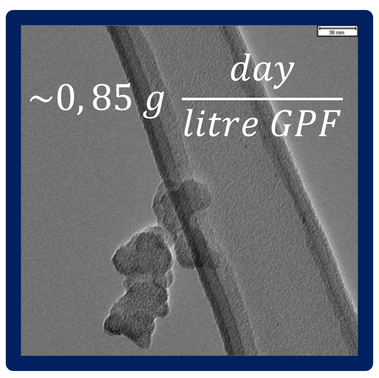


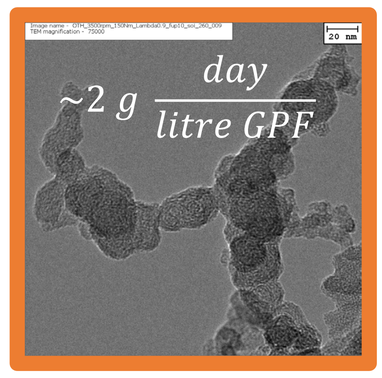
Regeneration:

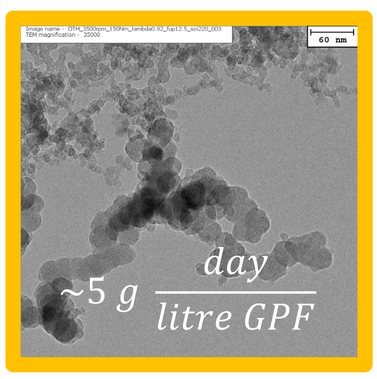


Efficiency GPF:









Conclusions:

- Extreme synthetic soot loading conditions change the primary particles (size and structure , TEM-figures)
→ especially lambda and if the spray impinges the piston
- The filtration efficiency and the deposition of the particles in the GPF is different to “normal λ = 1 settings”
→ problems for some sensors
- The reactivity of the soot in the GPF and the aerosol composition (Three Way Catalyst @ λ ≠ 1) is different
→ cross-sensitivity

References:

[1] https://eur-lex.europa.eu (EG) 692/2008 (EU) 715/2007 (EU) 427/2016
[2] Giechaskiel, B.; Manfredi, U.; Martini, G.: Engine Exhaust Solid Sub-23 nm Particles: I. Literature Survey, SAE Int. J. Fuels Lubr. 7(3):950-964, 2014
[3] AVL Powertrain, CAMEO 3, R8

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