



Next Generations of Gasoline Particulate Filters

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Agenda

Evolution of GPF technologies to meet stringent PN10 / PN23 requirements

Design criteria and boundary conditions

- Trip dynamics
- Fuel quality

Learnings and watch-outs from the PN10 introduction

Summary and conclusions

Evolution of GPF technologies

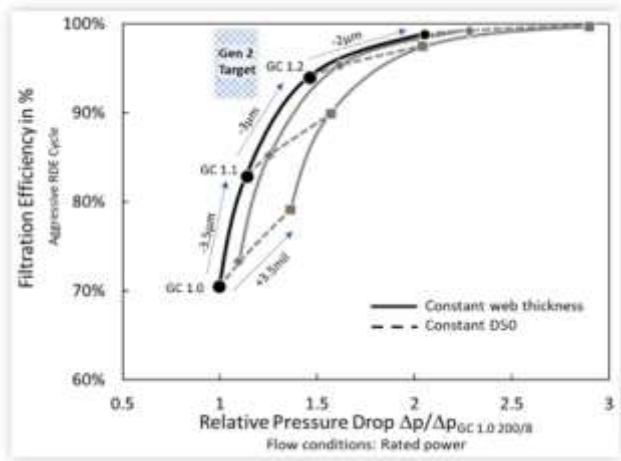
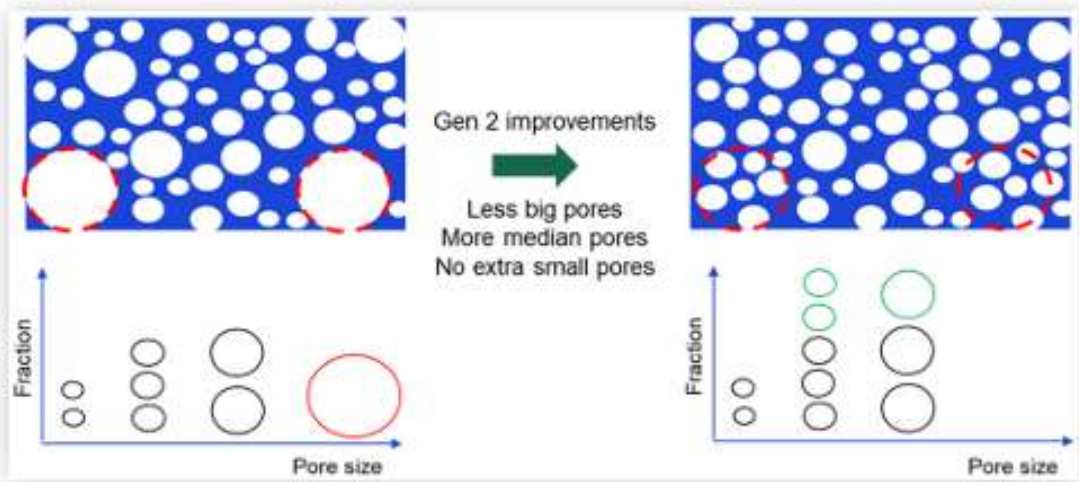
First GPF generation was tailored to meet NEDC and WLTC PN targets.

Introduction of RDE drove the need for a 2nd generation GPF.

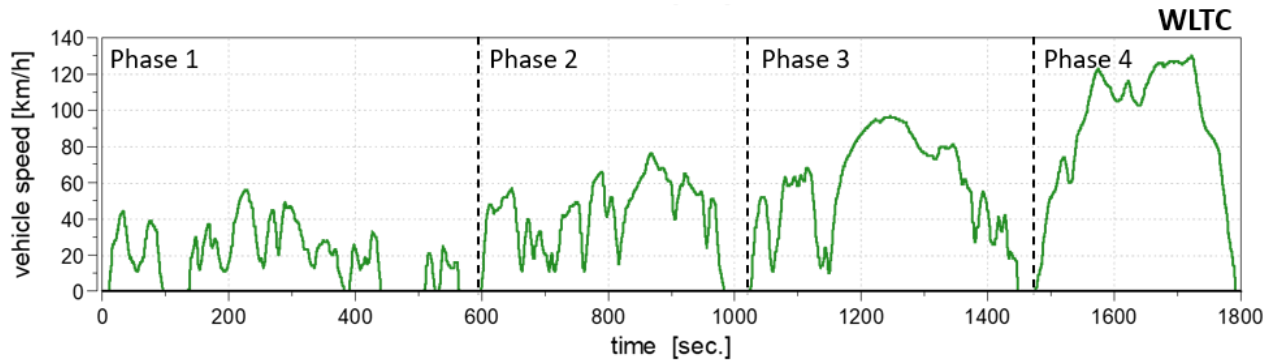
Bare GPF achieve high filtration efficiencies with APT* (Accelerated Purification Technology).

Coated GPF: advanced microstructures integrate three-way catalysts at high PN reduction and low pressure drop.

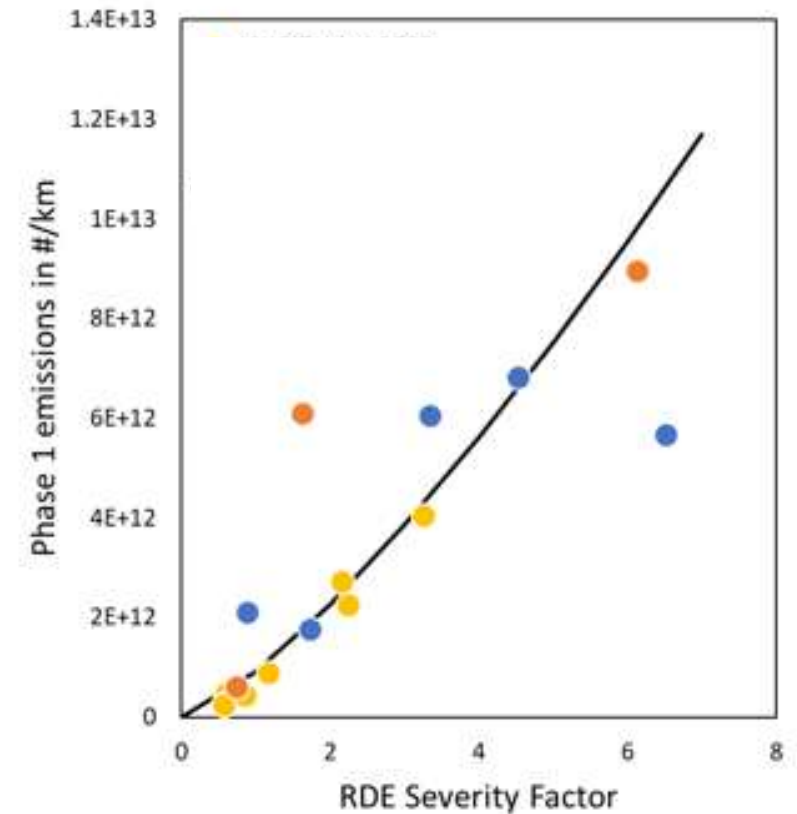
Generation	Bare GPF	Coated GPF
Gen 1	GC 200/8 (Medium Porosity)	GC HP 300/8 (High Porosity)
Gen 2	GC 2.0 200/8 APT*	GC HP 300/8 w/ advanced microstructures



FE requirements: WLTC versus RDE



- WLTC now has focus on CO₂ – In Europe typically not used to define filtration requirements
- EU-OEMs tailor RDE surrogate cycles to be challenging for the GPF component by using higher trip dynamics.
- Raw emissions are very sensitive to first acceleration within the cycle.

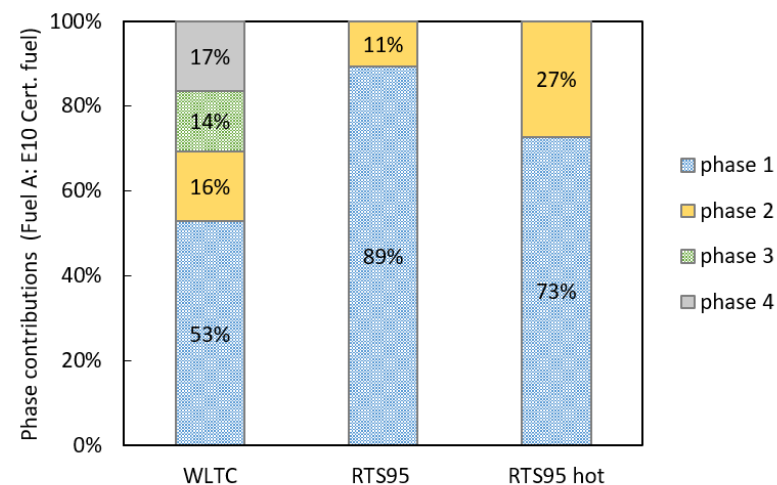
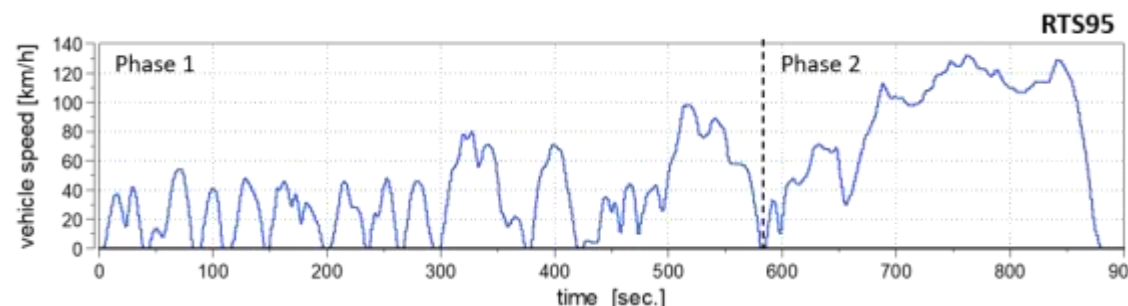


Corning RDE severity factor calculated with first acceleration, vehicle mass and engine temperature at start of test cycle. Different colors represent different vehicles.

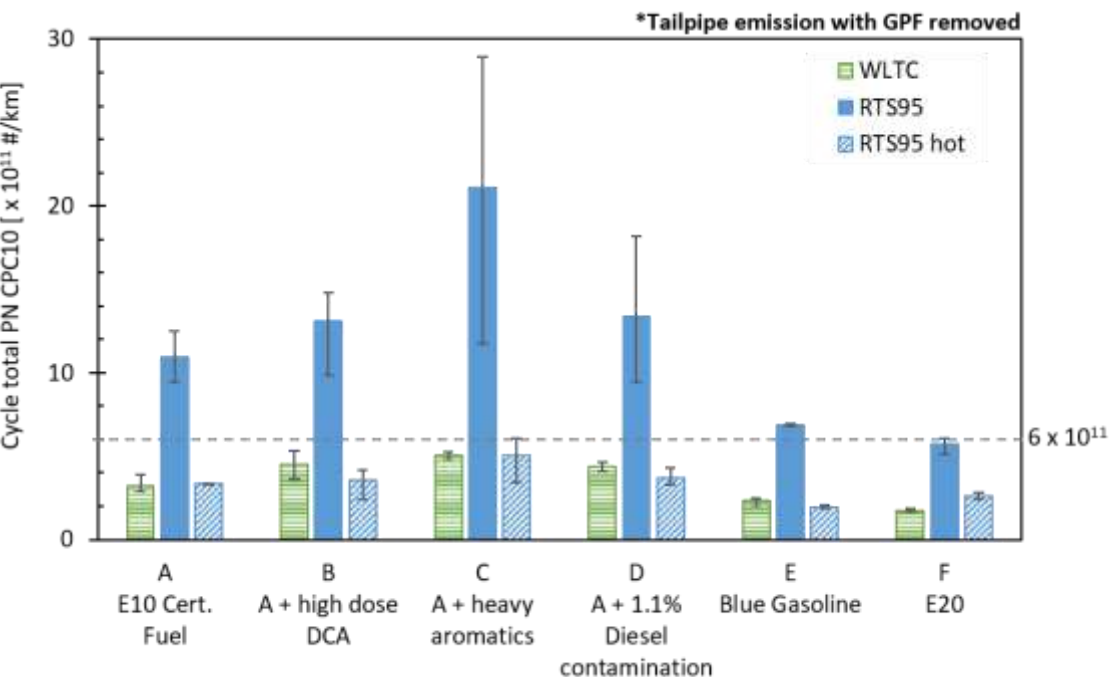
FE requirements: WLTC versus RDE (cont.)

Cold start, well represented by Phase 1 cycle emissions, dominates the cycle severity.

Example: RTS-95 tailpipe emissions (GPF removed) can be ~2x higher than WLTC emissions.

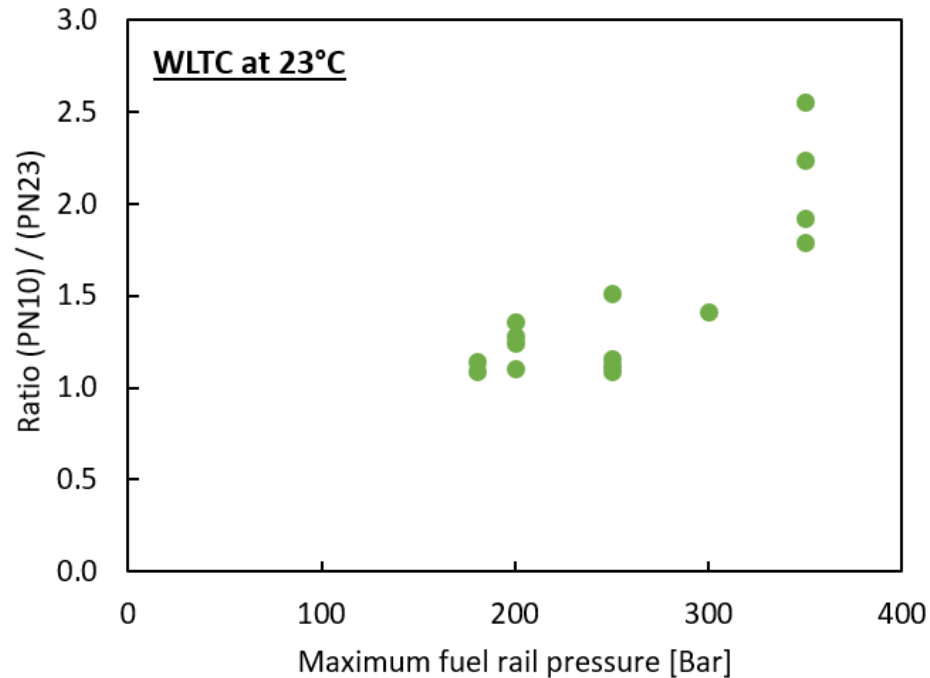


Fuel quality has a significant impact on PN formation



Chijiwa R. et al. :Impact from a variety of E10 and E20 gasoline formulations on PN10 and PN23 emissions evaluated in combination with advanced GPF technology generations, SAE 2023-32-0028

Impact from PN10 introduction - summary

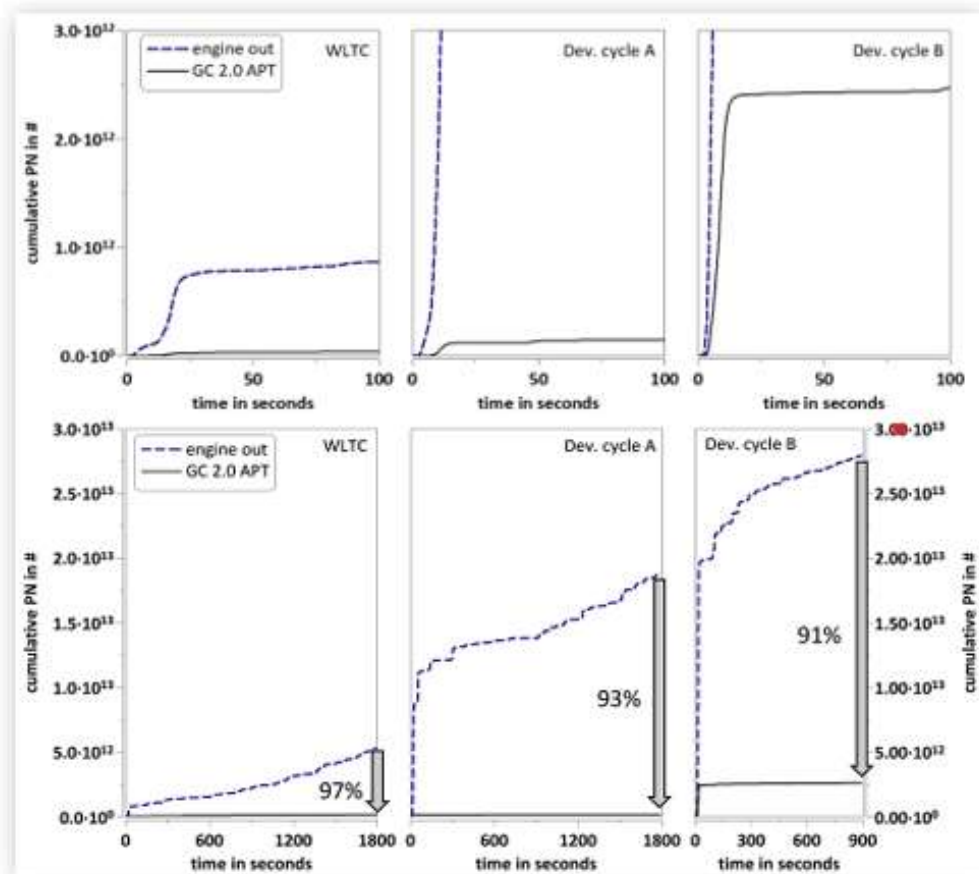


PN10 / PN23 ratio rises with maximum fuel rail pressure.

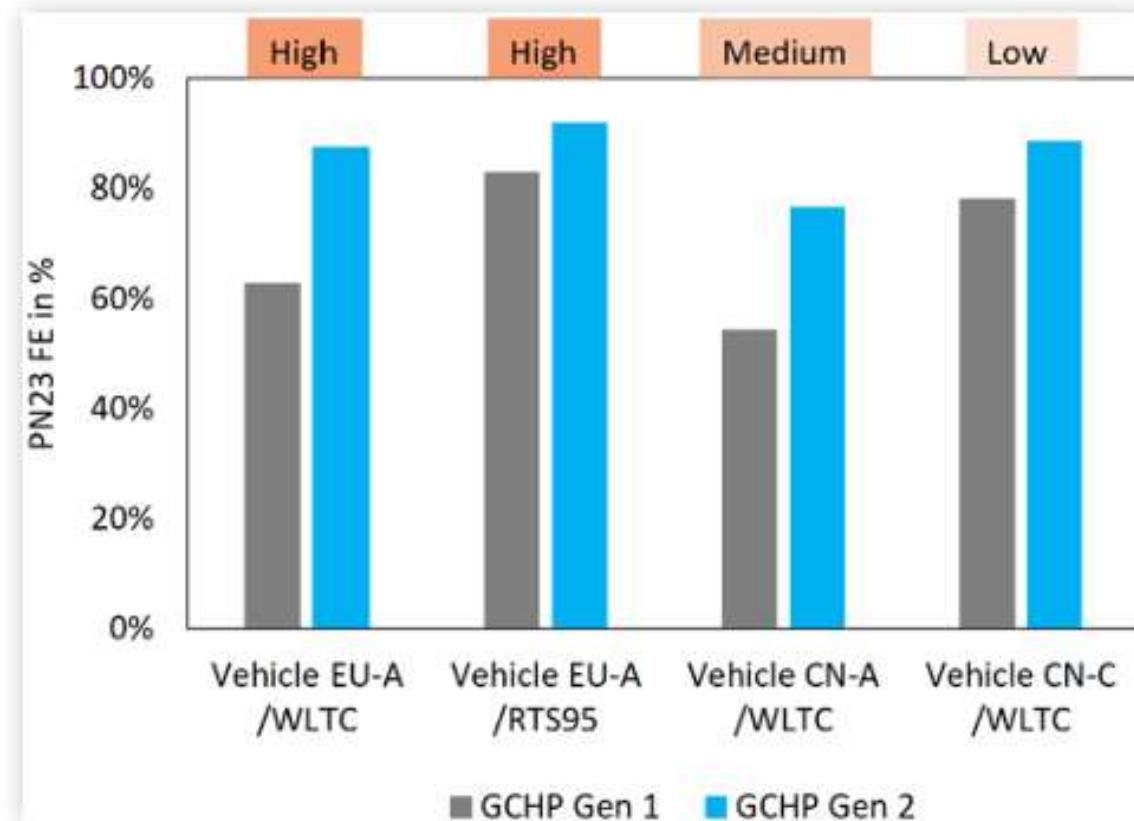
At WLTC and 23 °C the ratio ranges from ~1.1 to ~2.6 across the vehicle set.

Filtration efficiency: examples for bare and coated GPFs

GC 2.0 200/8 APT



GC HP 300/8 Gen 2.0

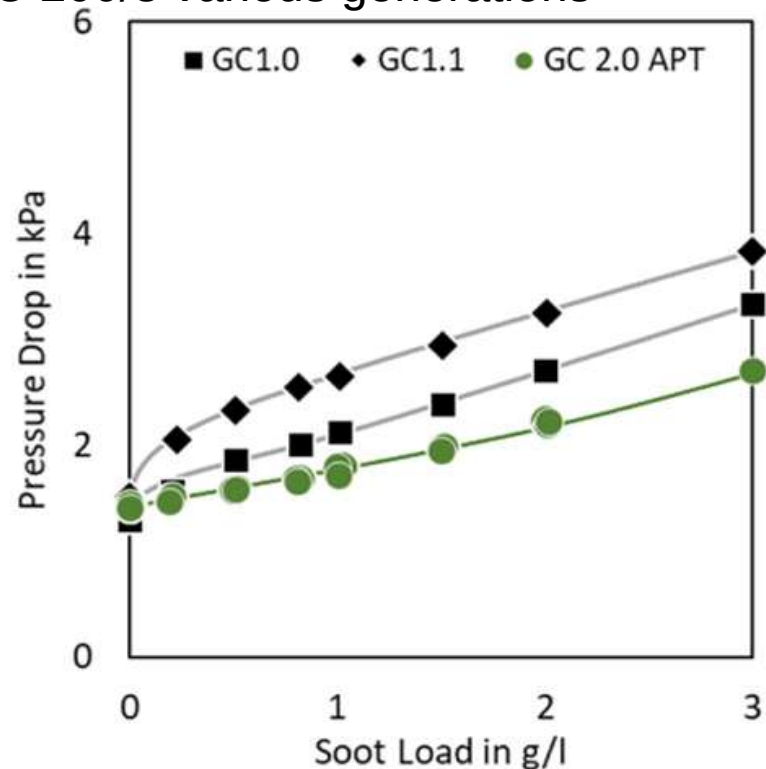


Boger et al, Next Generation Gasoline Particulate Filters for Uncatalyzed Applications and Lowest Particulate Emissions, SAE 2021-01-0584

Boger et al., Next Generations of Gasoline Particulate Filters for Catalyzed Applications, SAE 2024-01-2384

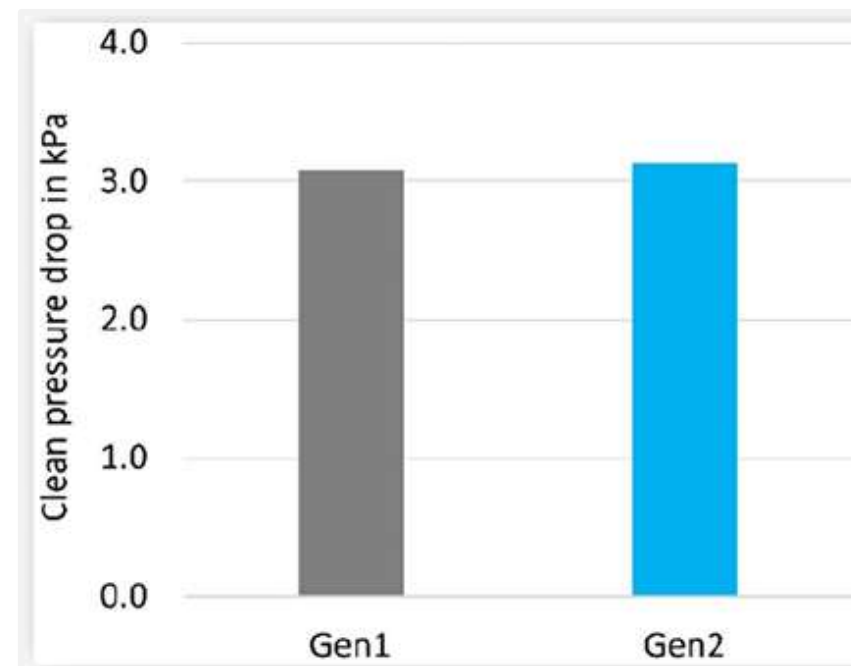
Pressure drop: examples for bare and coated GPFs

GC 200/8 various generations



GC 2.0 200/8 APT has a linear pressure drop with increasing soot load. APT prevents deep bed filtration.

GC HP 300/8 Gen 1 vs Gen 2.0



The advanced microstructure of GC HP 300/8 Gen 2 has no negative impact on pressure drop compared to Gen 1.

Summary and conclusions

Drivers of FE requirements: RDE dynamics, ambient temperature and fuel quality – not WLTC alone.

Engine start is decisive: Phase 1 dominates cycle severity and sets the filtration-efficiency need.

PN10 raises the bar: the PN10/PN23 ratio grows, e.g. with higher injection pressure.

2nd generation filters deliver: bare GPF with APT and coated GPF with advanced microstructures both enable RDE compliance in very challenging boundary conditions, beyond WLTC requirements.

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