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Next Generations of Gasoline Particulate Filters for Catalyzed Applications

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Outline

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- 2nd Generation GPF for catalyzed applications
- 3rd Generation GPF for catalyzed applications

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- 2nd Generation GPF for catalyzed applications
- 3rd Generation GPF for catalyzed applications

Summary

Introduction

Background

- Gasoline particulate filters (GPF) are a standard aftertreatment component for gasoline engines in Europe and China, and since 2023 India
- It is expected that the future Tier 4 regulations will also require the use of GPFs in North America
- For applications requiring high filtration efficiency in Europe, EU6e and EU7, Gen 2 and Gen 3 filters have been developed and are in broad operation today, e.g. DuraTrap® GC 2.0 and 3.0 filters
- Focus of these advanced filters had been uncatalyzed filter applications, which dominate in Europe
- In other markets like India, China and potentially the US, it is expected that high filtration efficiency filters for catalyzed applications will be required

Objective of this presentation is the introduction of **novel Gen 2 and Gen 3 filter technologies** for catalyzed filter applications, offering significantly increased filtration efficiency

Product concept

Product Concept
- GPF for Catalyzed Applications

The **first generation** of GPF for catalyzed applications, the DuraTrap GC HP 1.x filter family, was based on

- a 300cpsi and 8mil web thickness filter design
- highly porous walls, with ~65% porosity
- different median pore sizes for Δp/FE trade-off

Development objective for the new **second generation**, high porosity filter technologies, the DuraTrap GC HP 2.x filter family has been

- enhanced coated filtration efficiency at comparable Δp via improved microstructure (pore size distribution)
- while maintaining the general filter design and high porosity level

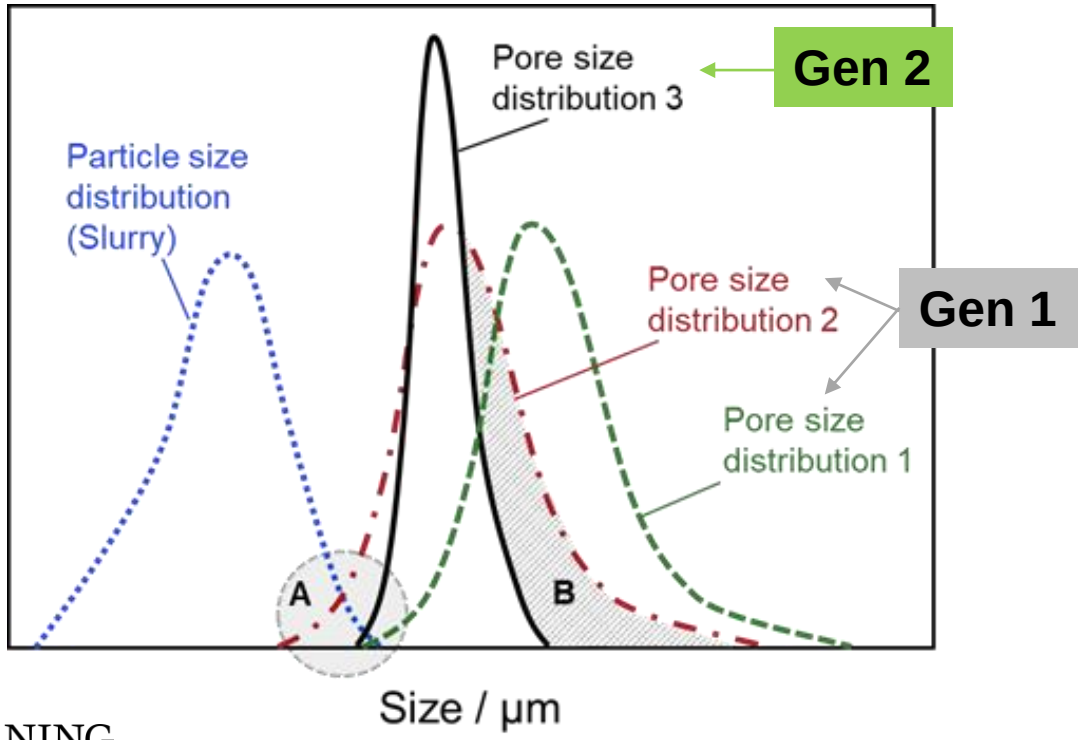
Development objective for the new **third generation**, high porosity filter technologies, the DuraTrap GC HP 3.x filter family has been

- enabling extremely high filtration efficiency also for catalyzed applications, analogous to the offerings for uncatalyzed GPF applications
- maintaining the high porosity base filter and applying an adapted version of Corning´s APT technology

Product Concept
- Second Generation GPF for Catalyzed Applications

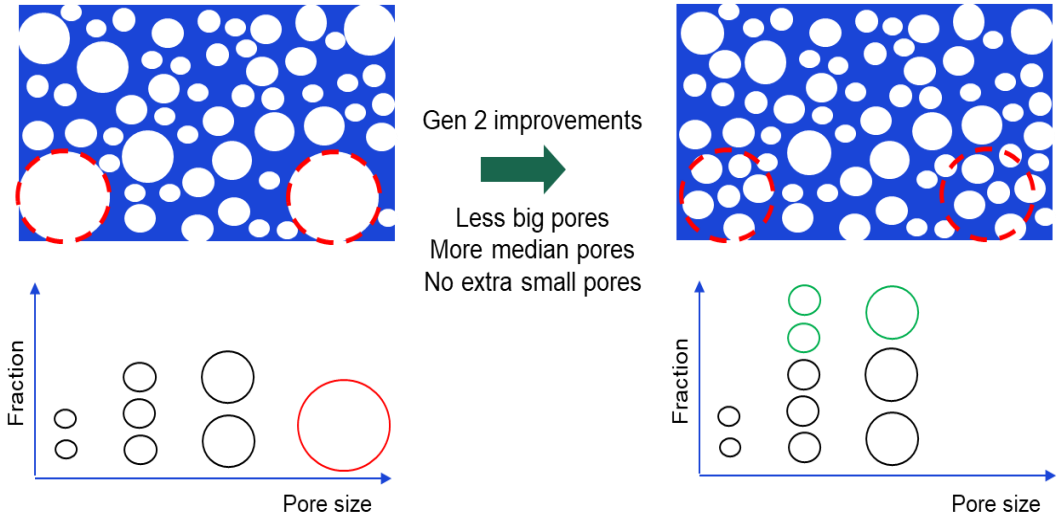
Basic product design

- Enabling a lower D50/D90 microstructure for increased filtration
- While maintaining the small pores (D10) large enough to minimize interaction with washcoat particles



Technical approach

- Narrower pore size distribution, primarily by eliminating the very large pores and maintaining the smaller ones

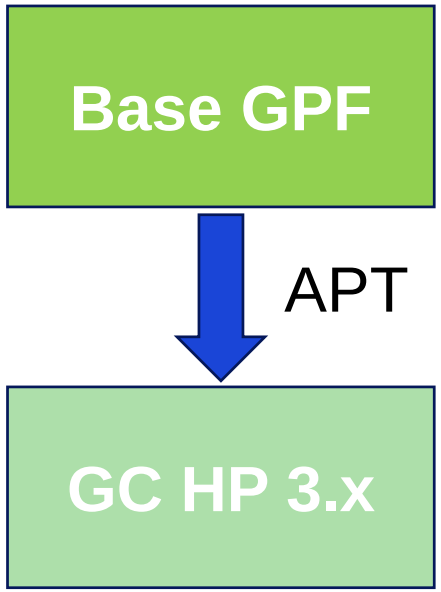


Product Concept
– Third Generation GPF for Catalyzed Applications

Basic product design

- Utilization of optimized base filter technology

- Increase filtration efficiency to very high levels by applying a modified version of Corning´s Accelerated Purification Technology (APT), creating a hierarchical pore structure with small inlet channel pores

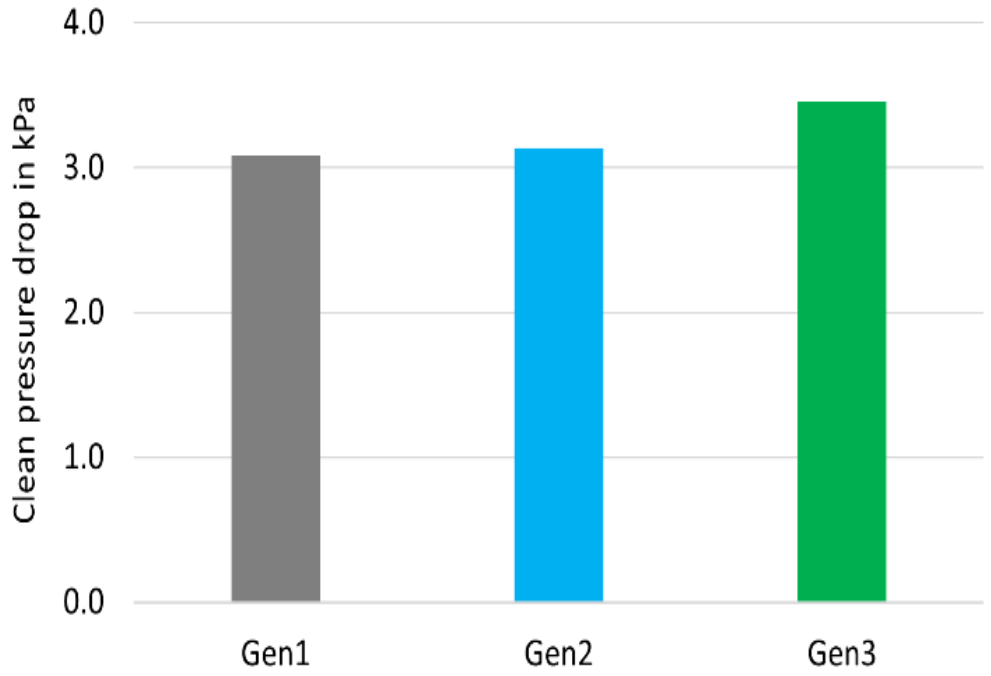


Testing Results

Laboratory Performance Testing Results

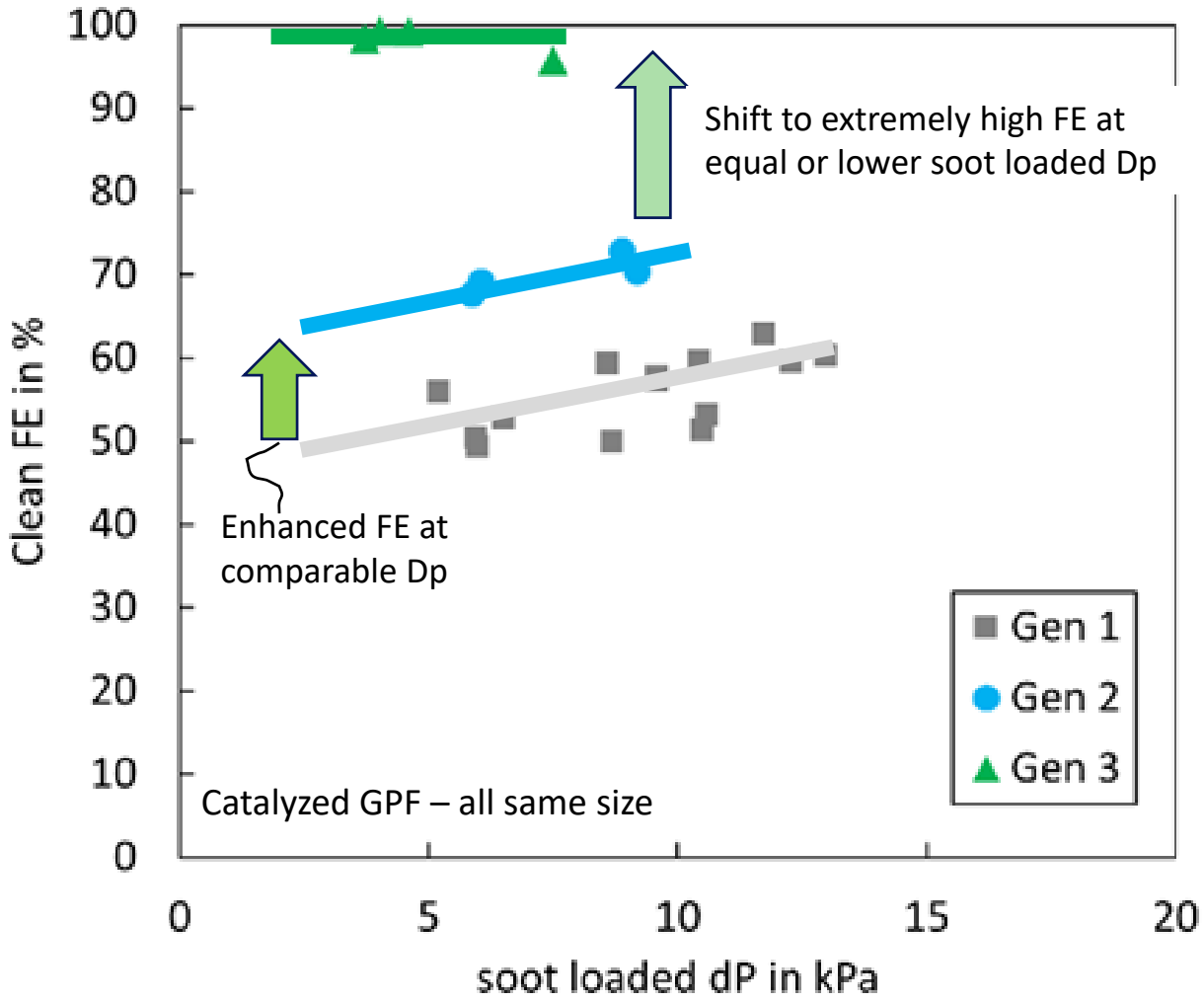
Clean pressure dop

- Laboratory test data confirm that the low pressure drop characteristics are maintained



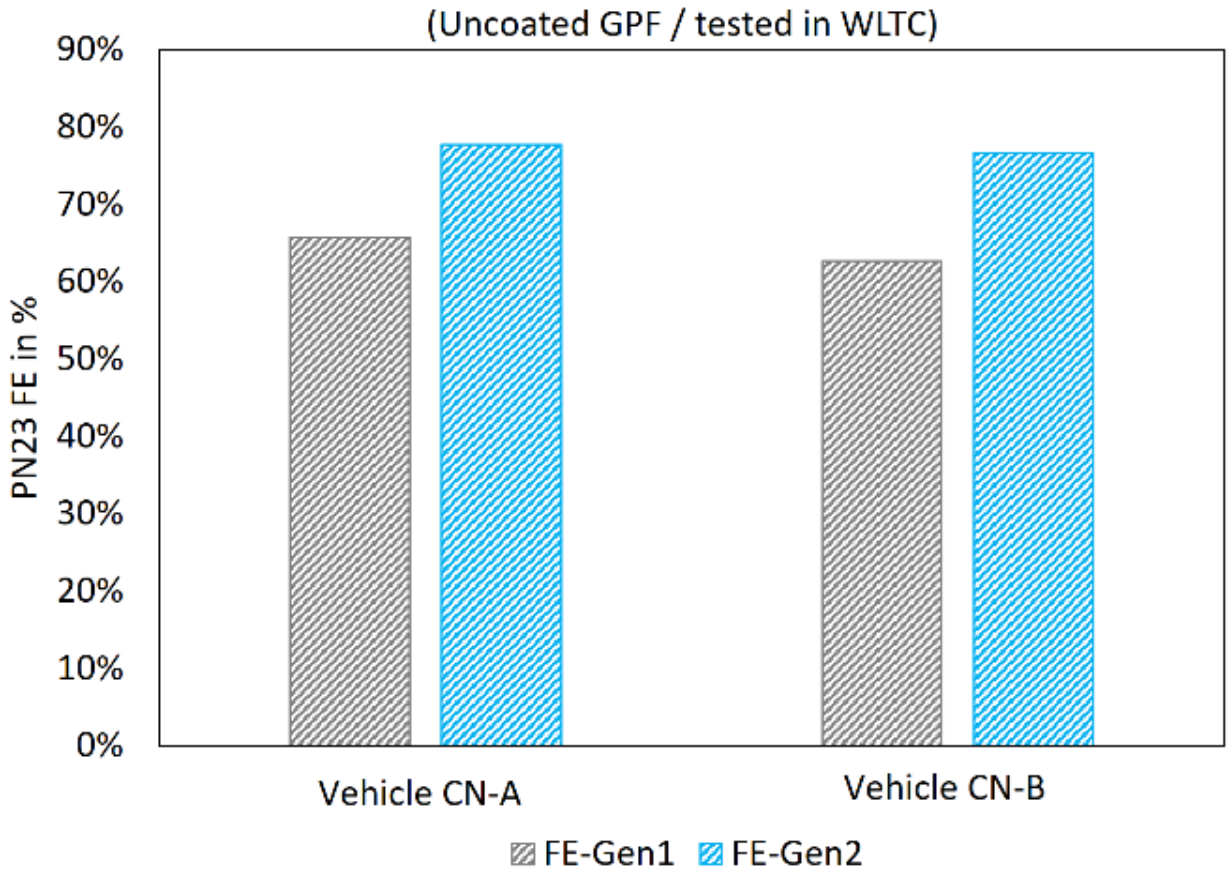
GPF catalyzed with low washcoat load

Filtration / soot loaded pressure drop



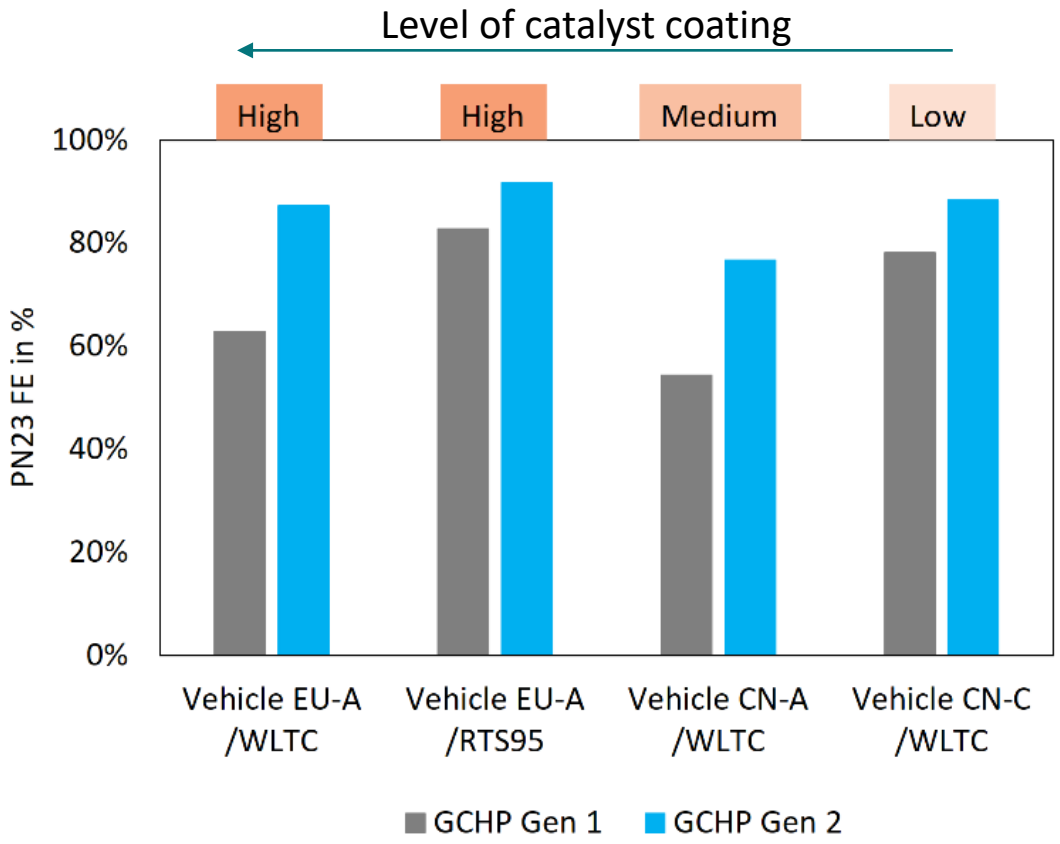
Results
– Vehicle Emission Testing of bare Gen 2 filters

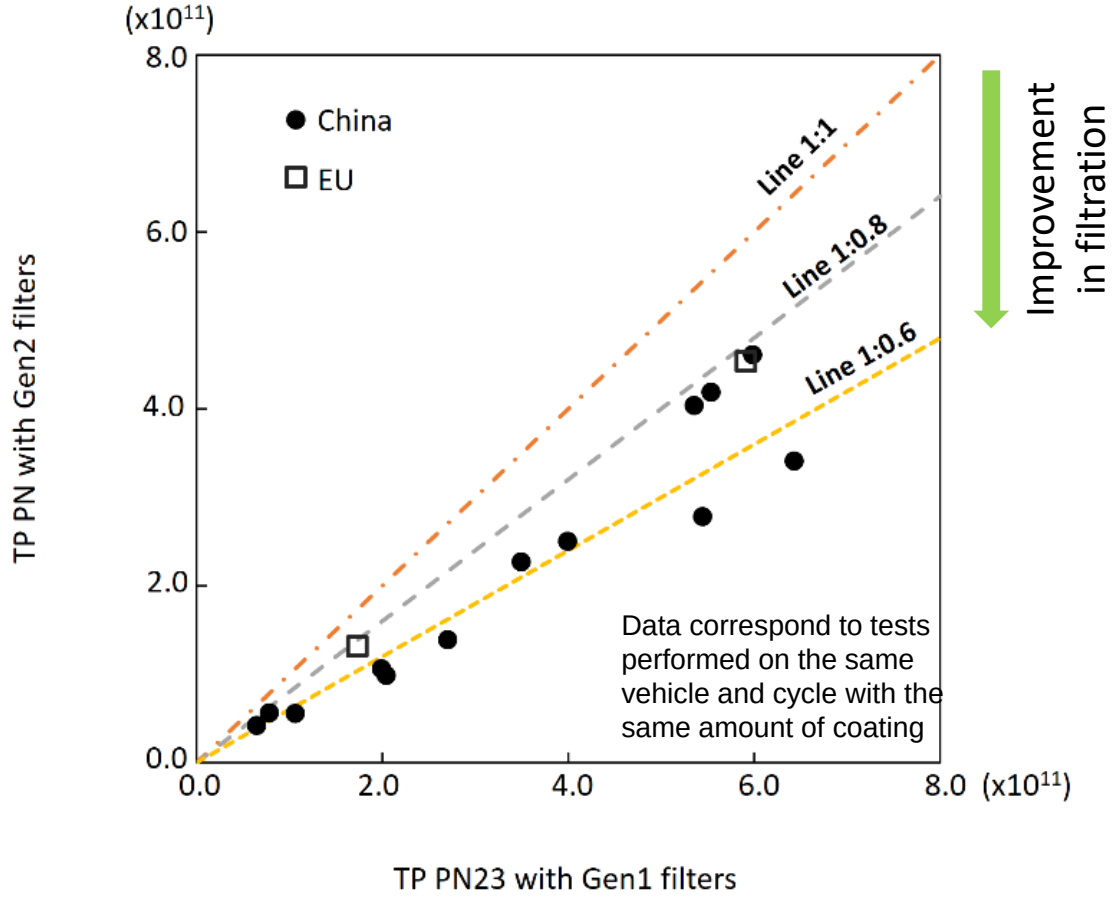
Testing of bare filters for vehicle emission performance confirmed the filtration benefits from the laboratory testing



Results
– Vehicle Emission Testing of Catalyzed Gen 2 filters

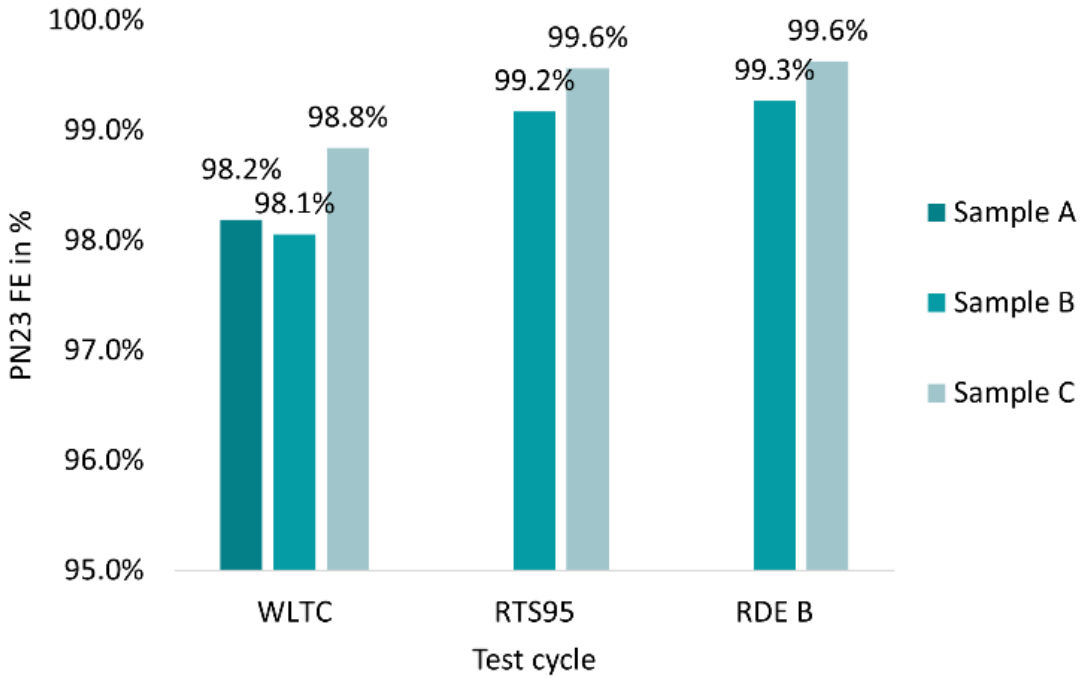
Filters with different coating technology were evaluated, demonstrating the filtration enhancement



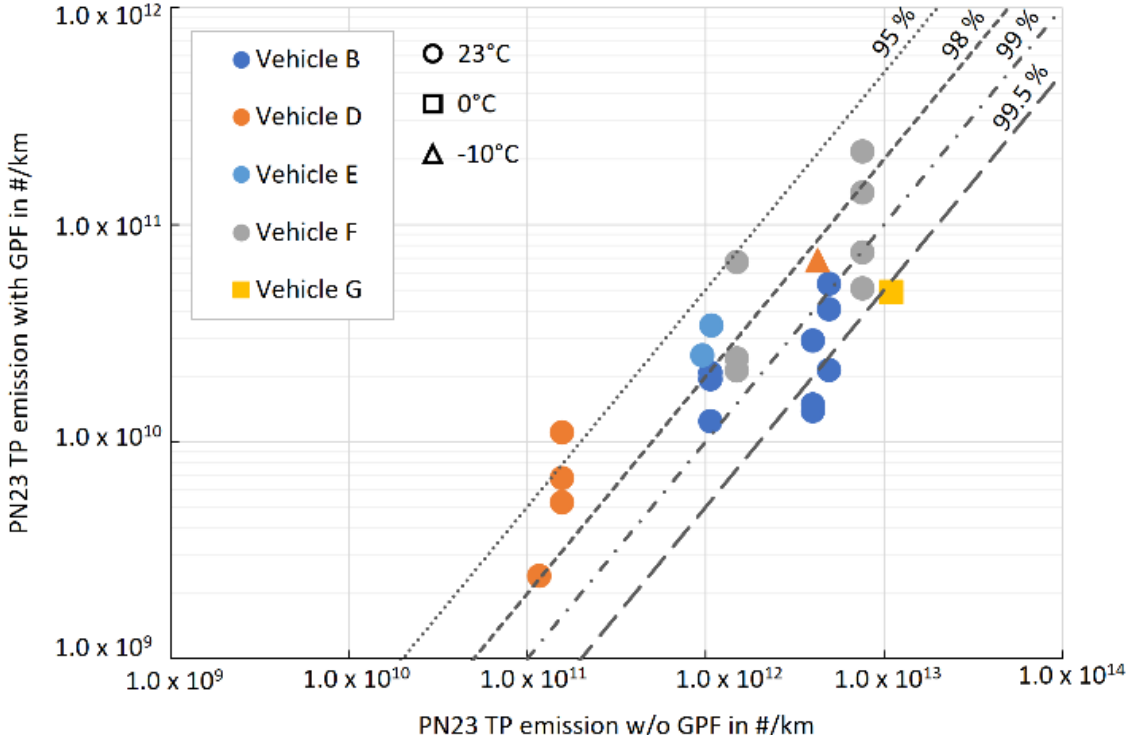


Results
– Vehicle Emission Testing of Catalyzed Gen 3 filters

Filters with different coating technology were evaluated, demonstrating the extremely high filtration efficiency achieved with the Gen3 filter technology



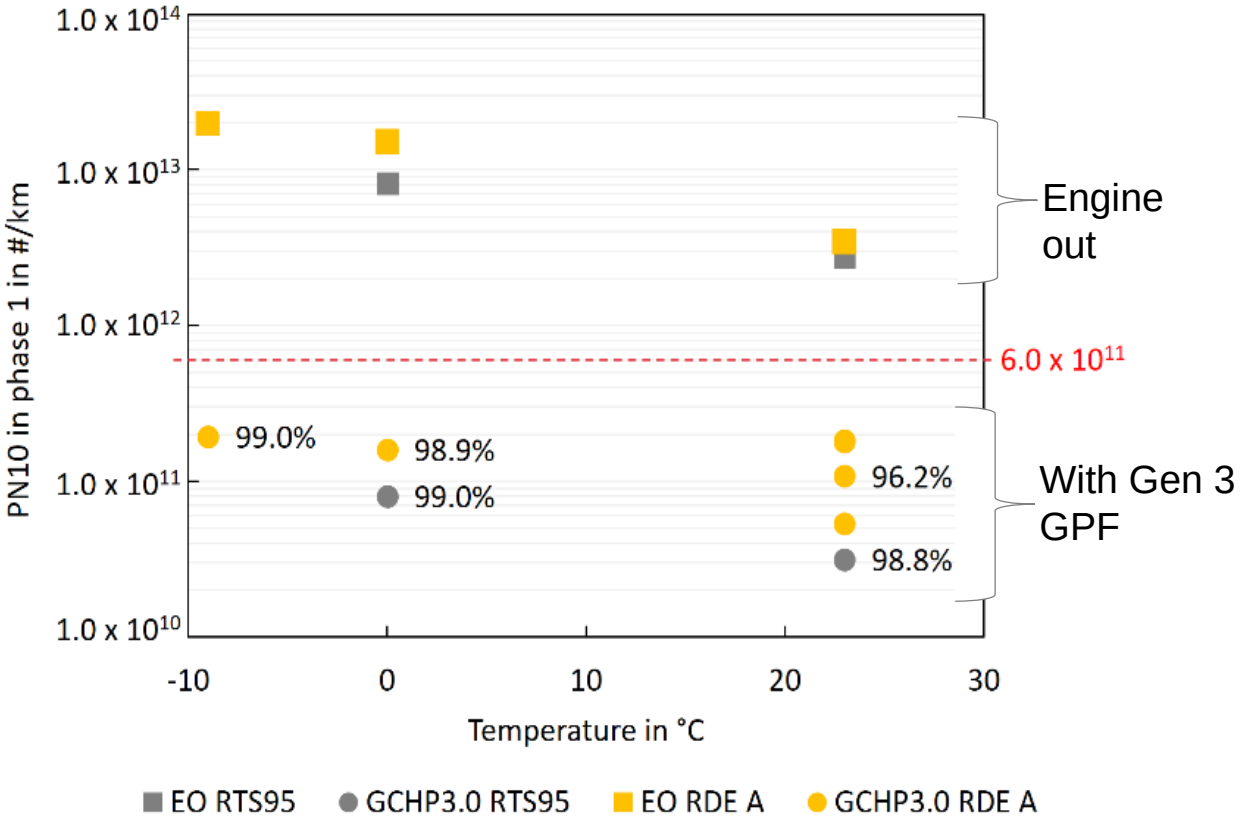
PN23 Filtration efficiency



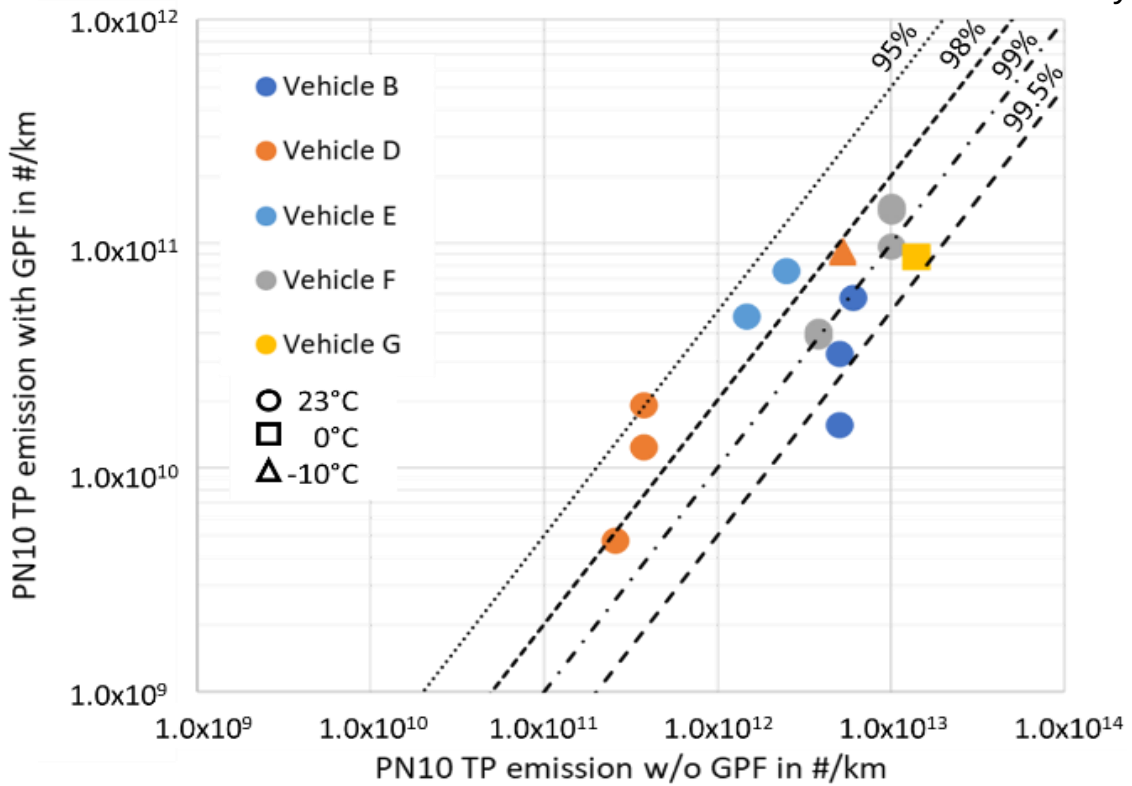
= Engine out PN emissions

Results
– Vehicle Emission Testing of Catalyzed Gen 3 filters – PN10

The extremely high filtration efficiency of Gen 3 filters is also confirmed for PN10 emissions over different test cycles and testing at different ambient conditions



PN10 Filtration efficiency



= Engine out PN emissions

Summary

Novel next generation GPF technologies for catalyzed applications have been introduced

- Gen 2 based on further enhanced microstructure with narrowed pore size distribution
- Gen 3 based on the application of Corning´s APT technology, adapted to catalyzed filters

The extended product portfolio allows to select the optimal product for catalyzed GPF applications depending on the needs

- Covering a very wide range of filtration efficiencies which can be achieved
- Optimized for lowest coated pressure drop

The performance of the new products has been demonstrated using vehicle emission test data obtained with multiple vehicles and under a broad range of test conditions

- Focus has been EU regulations, but the results are expected to be transferrable to US Tier 4 applications

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