



Gasoline Particulate Filter

- Ready for Particulate Number Real Driving Emissions -

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NGK

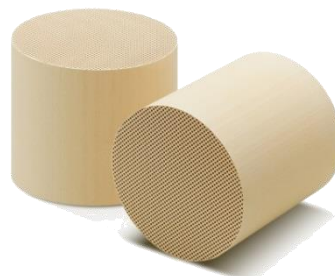
Definition

Background: Engine Technology and Legislation

Gasoline Direct Injection (GDI) engines cope to meet the CO₂ certification limit from 2021, but have the drawback of increased Particle Number (PN) emissions. On the other hand, PN legislation limit will be 6.0E+11 #/km from September 2017. In addition, certification of Real Driving Emission (RDE) including PN limit is planned 1st step from 2017 and stricter 2nd step from 2020. Gasoline Particulate Filter (GPF) is a strong candidate to cope with these RDE legislation limits.

Objective of this study:

The GPF made of Cordierite is based on the well established ceramic Diesel Particulate Filter technology. It's working principle and several results based on non-catalyzed and catalyzed GPF were presented in past ETH conferences. For this paper, NGK conducted PN measurement under RDE conditions using Portable Emission Measurement System (PEMS) and checked PN emissions to determine the GPF performance under coming future RDE legislations.



Test Vehicles:

- 1.8L GDI, $\lambda=1$
- 1.4L GDI, $\lambda=1$

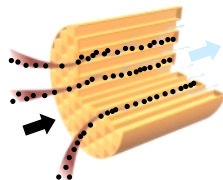
Evaluated Exhaust Layout:



CC : Close Coupled, UF : Under Floor

GPF Properties:

- Non-catalyzed GPF : 45 – 55 % porosity
- Catalyzed GPF : 60 – 65 % porosity



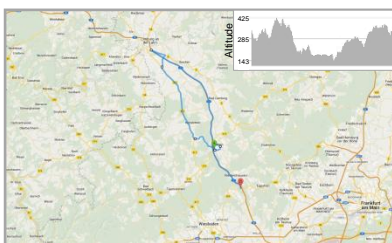
Evaluation contents of this poster

Test Cycle	PN emissions
NEDC test cycle	PN emissions
RTS 95 test cycle	PN emissions
RDE on road test	PN/ CO ₂ emissions

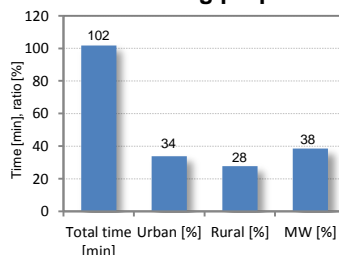
RDE test conditions with PEMS

RDE Driving route

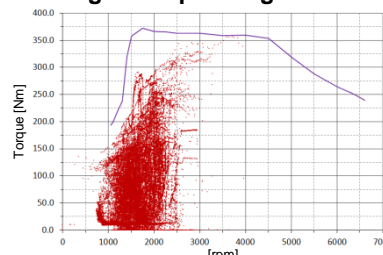
Vehicle : 1.8 L GDI, $\lambda=1$ EU5
with and without GPF in UF
(Non-catalyzed)



RDE Driving properties



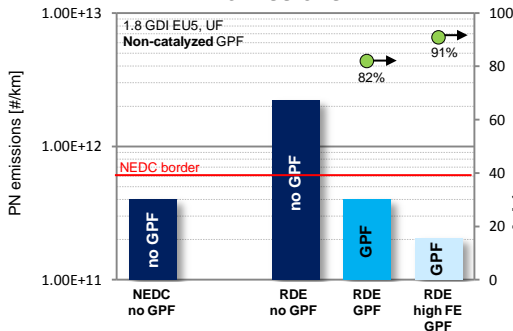
Engine map during RDE test



Particle number emissions were measured by PEMS based on the latest Real Driving Emission legislation information

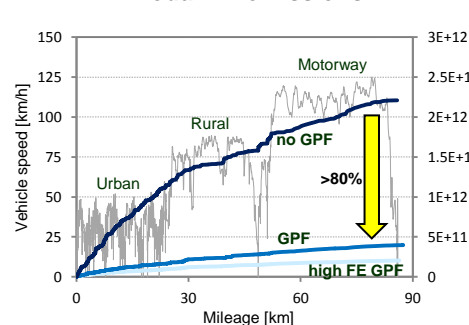
PN and CO₂ emission results in RDE test

PN emissions



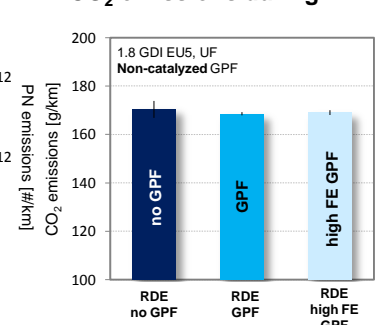
RDE PN was significantly higher than NEDC
GPF can achieve CF = 1.0

RDE Modal PN emissions



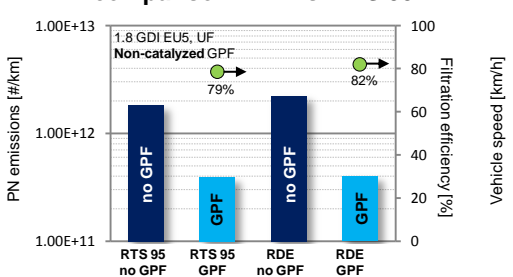
GPF traps PN well in whole range of RDE

CO₂ emissions during RDE



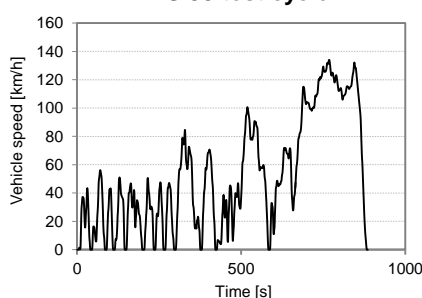
No measurable impact to CO₂ by GPF

PN comparison RDE vs. RTS 95*

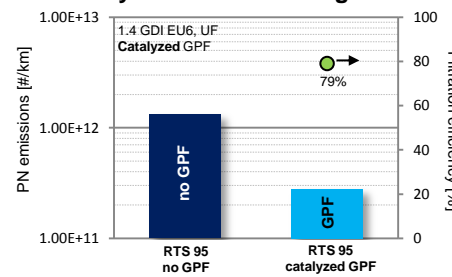


RTS 95 is comparable test cycle with RDE

*RTS 95 test cycle



Catalyzed GPF PN during RTS 95



Catalyzed GPF also well traps PN

Conclusion

- PN emission was measured following the latest Real Driving Emission (RDE) legislation
- PN emission was significantly higher during RDE test compared to NEDC
- Both catalyzed and non-catalyzed GPF can well manage RDE PN
- FE can be adjusted by GPF design modifications based on each system's requirements
- The GPF impact to CO₂ was not measurable and might be optimized by calibration work

Sufficient Filtration Efficiency
for Real Driving Emissions

No measurable CO₂ impact