

Controlling Nanoparticles Emission with Particle-Grouping Exhaust-Pipe

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Introduction

The nano-size particles weight is only 1-20% of the total particle mass while their number may be more than 90%. Due to their small size, their residence time in the air is much longer and so is the human exposure to these harmful particles.

Over the last years a number of attempts have been made to suppress the formation rate of particles inside the cylinder and to reduce the emitted particles mass with after-treatment devices.

The new EURO-6 regulations requires for the first time to reduce PN.

Experiments- GDI engine-NEDC COLD

Citroen C5 light-duty, 4-cylinder, GDI, 1600cc car equipped with a gasoline engine on a suitable roller test bench running the regulated standard driving cycle NEDC Cold with Grouping pipe and without between 2 mufflers.

Grouping Pipe

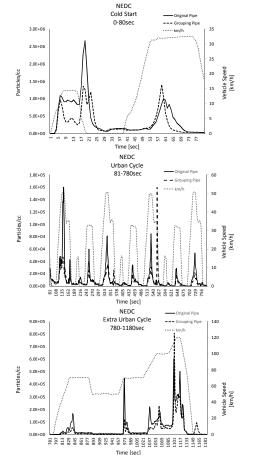
An average of 3 days with Grouping pipe and 4 days with Original pipe. Measurements taken after CVS with CPC device.

Original Pipe

6.4.10¹¹Particles/km

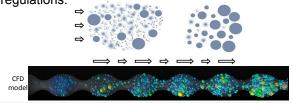


Particles number as collected at tailpipe with PPS:



Grouping Phenomenon

Small particles, in the nano scale range, have higher tendency to move as groups and cluster in an oscillating flow. In such conditions, particles may coagulate and increase their size, reduce the total particle number and comply with new EURO-6 regulations.



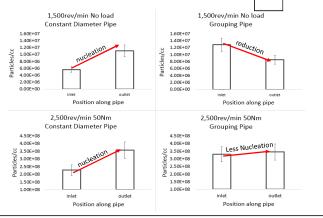
Experiments- Diesel engine on bench

E

ways valve

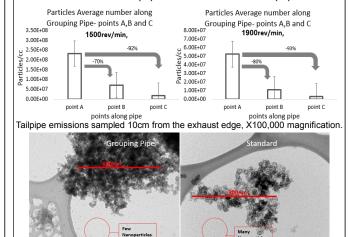
Constant Diameter

Ford Diesel engine, 4-cylinder, 2000cc on a test bench. PN measurements were collected Particle Sensor usina Pegasor (PPS) The PPS provides real-time data of the total number of particles in the range of 10nm to 2.4µm



Experiment-Diesel engine on EURO-4 bus

The original exhaust pipe section between the catalytic converter and the DPF was replaced by a groupingpipe. Measurements taken after catalytic converter(A), at the DPF entrance (B) and at the DPF exit (C).



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Winter, C., Katoshevski, D., Bartholomä, A., Flemming, B., (2007), Grouping Dynamics of Suspended Matter in Tidal Channels", J. Geophysical Research (JGR), Vol. 112: C08010, doi:10.1029/2005JC003423. August 2007