

8th ETH Conference on Combustion Generated Nanoparticles

POSTERS (ABSTRACT)

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Particle emissions of a TDI-engine with different lube oils.

Due to a growing concern about the health effects of fine particles (nanoparticles) from combustion engines the Diesel Particle Filter technology (DPF) was extensively introduced to the passenger cars in the last years. A very important parameter in this respect is the irreversible plugging of the DPF with non combustible ashes. The lube oil quality, especially the ash content has an influence on the cleaning intervals of diesel particle filters.

The mission of this work was to study the influence of different oils with different sulfur contents on exhaust particles production, with the measurements of: particle mass, nanoparticle size distribution, tracing of lube oil and differential analytics of measuring filter residue.

In theory a part of the oil layer which lubricates the walls of the cylinders takes part on the combustion in heterogeneous mode, this is one of the sources of particles. Another important one is the crankcase-ventilation. The particles, with sizes in order of nanometers, are composed among others of elemental carbon and sulphates. The question was to know how different oil qualities will influence this emission component.

The results are surprising, oils with reduced sulfur and lower additive content, don't necessarily reduce the particle emission of the VW-TDI engine ! The observed emission differences are certainly an effect of combination of different influences, like:

- acting of the oil with the piston rings and cylinder wall due to its viscosity
- influence of the oil on blow-by flow and blow-by composition
- acting of the oil at the cylinder walls during the combustion, oil evaporation, adsorption and desorption of fuel
- influence of the oil composition on the particle composition and on the condensation effects (speed of droplets growth).

The complex influences of oil quality on the particle emissions offer several open questions for further research

Particle emissions of a TDI-engine with different lube oils.

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ABSTRACT

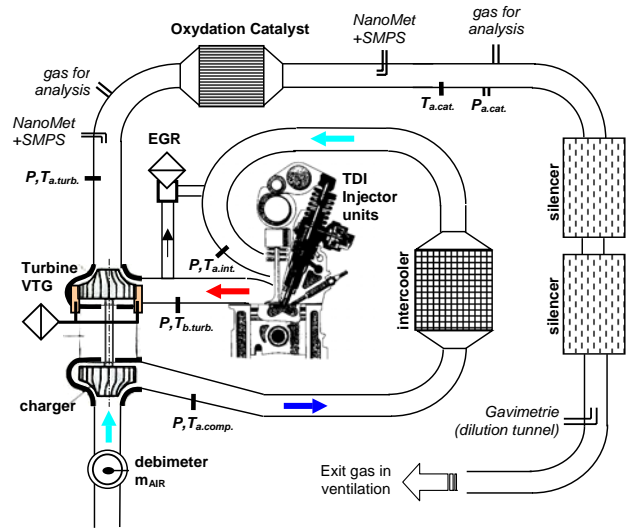
Diesel engines as gasoline engines consume oil and produce harmful exhaust gas components. These like HC, CO, NOx are limited but the nanoparticles especially produced by engines with heterogeneous combustion are not limited. The mission of this work was to study the influence of different oils **with different sulfur contents** on exhaust particles production.

Property	Unit	Motorex 15W40	Lubrizol Red 15W40	Castrol SAE 5W30	Lubrizol Blue 15W40	Lubrizol Green 5W30	DEA DES-6089
Viscosity kin 40°C	[mm ² /s]	108.9	104.8	70.57		69.76	94.92
Viscosity kin 100° C	[mm ² /s]	14	14.22	11.6	13.98	11.8	13.45
Viscosity index	[-]	135	139	159		166	142
Density @ 15°C ou 20°C	[g/ml]	0.885		0.8617			0.8392
Total Base Number	[mg KOH/g]	11.1	13.5		8.4	5	0.55
Pourpoint	[°C]	-27		-54			-54
Sulphated ash	(%)		1.8	1.52	1.077	0.47	
Sulfur	(%)	0.73	0.65	0.42	0.336	0.2	0.0005
Mg	(%)	0.0422	0.001	0.04	0.001	0.022	
Zn	(%)	0.1572	0.127	0.14	0.12	0.105	
Ca	(%)	0.3655	0.473	0.33	0.263	0.06	
P	(%)	0.1433	0.116	0.13	0.111	0.095	
Mo	(%)	0.0116					

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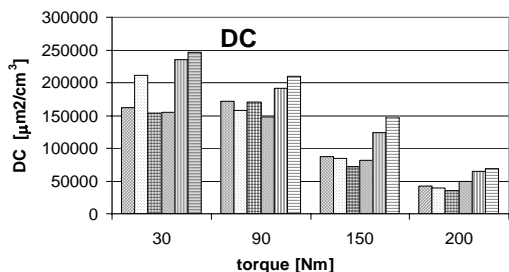
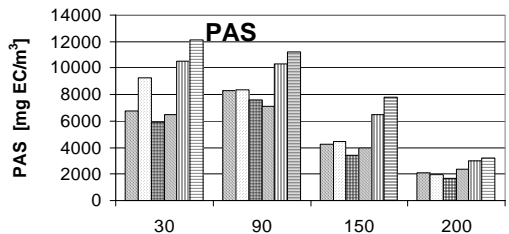
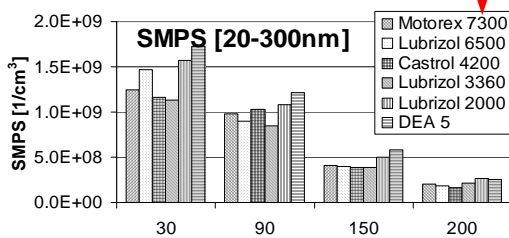
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oils with reduced sulfur and lower additive content, don't necessarily reduce the particle emission of the TDI engine !



Nanoparticle emissions with different lube oils

before catalyst, at 2000rpm **ppm S**



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Particle mass emissions with different lube oils at 2000rpm

