

Soot particles and gas phase characterisation on simulating a Diesel Particulate Filter charge

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Diesel engines power major of the trucks, buses and since 2007 more than 50% of cars in France. As Diesel exhaust causes health hazards, the reduction of Diesel pollution has become a public priority. Diesel engines emit large quantities of particulate matters (PM) and nitrogen oxides (NOx), both precursors of photochemical smog. The study of the air quality in urban area, initiated in the fifties, had clearly demonstrated the link between pollution and mortality.

Soot particulates less than 2.5µm in size are most specifically dangerous for human health. Diesel Particulate Filters (DPF, Figure 1a) are the most effective solution for reducing the PM emissions. The filter durability is closely entailed by the successful control of periodic regeneration by combustion of the deposited particulate.

In this study, we investigated the effect of a pressure increase above a DPF on soot composition, while charging it. Soots were generated by using a Combustion Aerosol Standard generator (CAST *Jing* Burner) and we simulated a DPF by using a valve. The gas phase analysis was monitored with a micro Gas Chromatographer (µGC) and the particle phase with an Aerosol Mass Spectrometer coupled to a Scanning Particle Mobility Sizer (AMS, SPMS) (Figure 1). AMS and SMPS give precious information on the particulates concentration, size distribution and also on the chemical composition of the particulates. It allows a real time test with information on the impact of particle size on treatment efficiency and therefore the possibility of key parameters identification for improved particle removal.

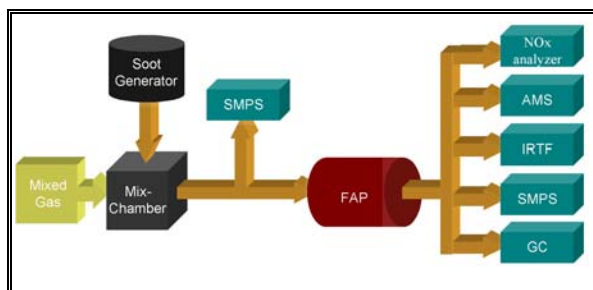


Figure 1. Diagram of experimental Setup

Soot diameters were found in the range of 35 – 180 nm according to the operating conditions of the burner (propane/air ratio).

Since the pressure above the valve increased slowly, the gas phase is slightly changing. New

gaseous species appeared that should be related to a less complete combustion process. Simultaneously AMS measurement campaign has shown that organics were mostly present on the soot particles surface. By comparing simultaneously AMS to SMPS data respectively, we can approach the soot particle density. Further analysis of the AMS data is being done (figure 2).

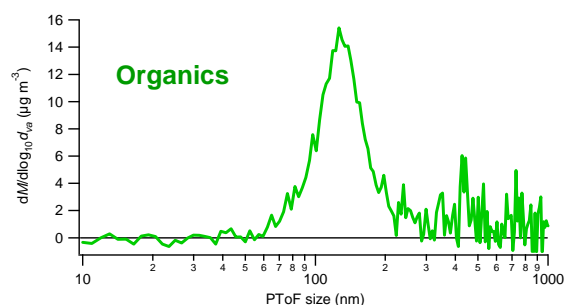


Figure 2. CAST generated soot Particle Time of Flight (PTof).

This study is the introduction of a larger project that aims at developing an Innovative Process for Reducing Emission of Particulates from Diesel exhaust (IPREP), introducing new catalysts based on electrochemical promotion for Diesel particulate filtering. This type of catalyst will enable low temperature filter regeneration, therefore preventing increased fuel consumption during regeneration process (as currently occurring) and reducing the associated costs. IPREP is a 3 year project which involves 5 french laboratories and 2 french companies.

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