Contribution ID: **27** Type: **Talk**

Studies of combustion engine exhaust: An in-situ laser induced fluorescence oil consumption method and simulations of Diesel particulate matter via laser desorption time of flight mass spectrometry.

Tuesday, 30 September 2014 10:35 (25 minutes)

Combustion engines are still largely the most commonly used in the automobile industry. Higher efficiency and a better knowledge of internal processes are constantly pursued by engineers. Optimization and improvements can be made by monitoring the exhaust stream. Oil consumption method is one of the most interesting techniques to reach that goal. In-situ and on-line techniques based in SO2 laser induced fluorescence constitute the best approach. Our department has built and designed an apparatus consisting on such a methodology1. The robust mobile prototype delivers reliable data within a very short acquisition time, and with a limit of detection down to 25 ppb. The incorporation of a steady and easy to handle optical parametric oscillator has been essential to perform a commercial system. Oil consumption data acquired in different engine regimens (load and r.p.m.) represents the final step of the long engine development. Another component in the engine exhaust such soot and aerosols, are related to the efficiency as well. These compounds are produced during combustion processes, especially in diesel engines. The number of them and the size are regulated by law and the incoming Euro 6 will become more restrictive. However, one key aspect is still being the composition of such particles. Composition and formation process are critical to minimize their generation as well as for understanding the internal engine processes. Therefore, structural studies need to be performed. Laser desorption (LD) sources can be used since thermally labile molecules can be introduced into an adiabatic regime. The created clusters can be investigated by time of flight mass spectrometry (TOF-MS). A new LD source based on a channel-type desorption source2-3 was set up. Mass spectra of the steadier aggregates formed in a relatively low effective temperature regime, might be recorded. Carbonaceous substances will be investigated as a model of soot particles. The aggregation of those with sulphur containing aromatic compounds (existing in oil and fuel) might be used as a model of exhaust aerosols. Comparison with desorbed soot under same conditions could reveal critical information about the nucleation and growing processes.

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Session Classification: Session 3 Spray and particulate matter (Ossler)