Elemental composition of particulate matter collected from in-use Diesel engine passenger vehicles measured by Laser Induced Breakdown Spectroscopy

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Abstract

In this study we apply Laser Induced Breakdown Spectroscopy technique for qualitative and quantitative spectrochemical analysis of Diesel Particulate Matter (DPM) emitted from in-use Diesel combustion engine exhaust emissions.

We analysed particulate matter from sixty-seven different Diesel engine passenger vehicles of major EU car producers used in daily life environment. The aim of this study is to compare Particulate Matter (PM) composition, mainly agglomerated major and minor chemical elements. Especial attention is given to analyse different PM and perform a quantification and calibration of LIBS spectral signal. The presence of agglomerate chemical elements in Diesel exhaust emissions are due to different processes involved within the combustion. These are mainly related to the Diesel fuel, fuel additives, engine performance, applied aftertreatment devices like selective catalytic reduction devices and Diesel particulate filtering techniques. All these input parameters influence the final chemical composition of exhaust emissions as well as the Diesel particulate matter emitted from in-use Diesel engine vehicles.

Diesel powered cars currently fail to fulfil the *Euro* vehicle emission standards in real driving situations, due to the strictness of the emission norms. The existing emission standards like *Euro*, *Tier*, or *LEV*, for Diesel engine passenger vehicles specify the maximum allowable emissions of hydrocarbons, carbon monoxide, nitrogen oxides and PM as the total number of all particles, expelled from Diesel exhaust fumes.

Currently there are none specific emission standards for additional compounds or chemical elements contained in the exhaust emissions i.e. exhaust vapour, Diesel particulate matter, particulate matter, black carbon, or in the soot, formed by the Diesel or biodiesel, from combustion driven engines. Even though agglomerated chemical elements additional to carbon, presents a very large fraction of the total DPM or soot emission contents. Particularly the inhalation of metal dusts and ions has numerous negative health effects, especially upon long-term exposure. Automotive emissions are considered as the dominant source for airborne metal pollution in urban areas. Therefore accurate in-situ technique to assess the on-line elemental composition of particulate matter from automotive emissions would be desirable.

Keywords: *LIBS, Particulate Matter, Diesel Particulate Matter, Carbon Black, Soot, Diesel emissions, Diesel engine, in use vehicles.*

Biography

Dr. Richard Viskup is a research scientist at Johannes Kepler University Linz in Austria. His interests are oriented to wide directions from: applied physics, photonics and spectroscopy to environmental science. His current research is dedicated to measurement of exhaust emissions from Diesel engine, where he use laser induced breakdown spectroscopy technique for Particulate Matter and soot emission measurements from Diesel engine vehicles.