Plasma soot removal system for diesel exhaust gas

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Abstract:

Diesel engines emission contains of large quantities of fine particulate matter, which mainly consist of carbonaceous material and soluble organic fraction (SOF). Some constituents of the SOF such as polycyclic aromatic hydrocarbons (PAHs) and nitrated derivatives (nitro-PAHs) are mutagenic and/or carcinogenic. Mentioned emissions can be controlled either at their source or by after-treatment technologies. The two approaches are in fact complementary and must be followed simultaneously. One of the most effective and commonly employed particulate control devices is corona plasma systems, which are used extensively since give high precipitation efficiency, low-pressure drop and compact construction. The present work is focused on developing and testing efficient method using cold plasma system for eliminating of fine particulate matter from diesel exhaust gas.

For the purpose of this research, numerous collection efficiency measurements have been performed for various geometric and electric parameter settings under laboratory condition. The results of research carried out to optimize electrode configuration using five kinds of electrodes, indicate that the collection efficiency obtained with grid electrodes was higher in respect of plane and punched electrodes and it will be decrease by hole size increasing. Other investigations, which performed to determine the effect of carrier gas direction, showed that the collection efficiency for parallel flow is more than double lower than that for cross flow. The data obtained also demonstrate that the collection efficiency of selected electrode weakly affected by soot concentration. In addition, the system showed a negligible and satisfactory variation in collection efficiency vs. time in 35 min. interval. In the last step, experimental results of fabricated system under real condition indicated that the collection efficiency about 70% was achieved with Minibus Benz Model O508 exhaust gas operating in steady-state condition.