NOX REDUCTION FROM CI ENGINES WITH DC CORONA DISCHARGE - AN EXPERIMENTAL STUDY

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An experimental study of DC corona discharge technology for NOx reduction from diesel engine exhaust is presented. The DC corona reactor consists of a flat electrode against a multi-needle electrode. The results are presented in terms of the cleanness (the mass of removed NOx referred to its initial mass), and the energy consumption (the mass of NOx per unity corona electric energy). For both cleanness and energy consumption, negative polarity (negative needles) is preferable. The cleanness was found to be independent of the engine load. The results show that the performance of a DC corona reactor depends on the reactor length, electrodes' separation distance, and needle's density. The effectiveness of the NOx decomposition was mapped, and optimal geometrical parameters for the best reactor performance have been obtained. It is concluded that for best performance, the residence time of the exhaust gas inside the reactor should be longer than 1.2 seconds; the electrodes' separation distance must be shorter than 30mm (in order for the electric field intensity to remain sufficiently high for dissociation reactions); and the needles separation distance must not exceed 20mm (in order to provide sufficiently dense distribution of plasma regions from each needle). The cleanness and energy consumption values for the optimal geometry lay between 55%, 17.2gr-NOx/kW-h, and 46%, 27gr-NOx/kW-h for needles separation distance of 10 and 20mm, respectively.