Minimization of Nitrogen Oxides in Automotive Internal Combustion Engine Exhaust Emissions

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By improving the engine design and optimizing the adjustable parameters of the working process, it is possible to significantly reduce nitrogen oxide emissions; however, it cannot be ruled out that at certain engine operating modes, NOx emission levels may considerably exceed the strict standards established by the law, and the additional purification of exhaust gases from nitrogen oxides remains relevant.

The article considers the measures applied to neutralize toxic substances in the exhaust gases of gasoline and diesel engines. Based on their analysis, it is shown that it is desirable to replace the existing methods and devices for neutralizing harmful components in exhaust gases with more effective neutralization means. The study of the mechanism of nitrogen oxide neutralization in exhaust gases using existing methods showed that the bond between nitrogen and oxygen atoms can be broken through atomic hydrogen. This is particularly significant for prospective hydrogen-powered internal combustion engines, in which the only legally restricted harmful component in the exhaust gases are nitrogen oxides. It is hypothesized that dissociated atoms obtained by passing hydrogen molecules through an electric discharge arc should be introduced into a reaction with the exhaust gases of the internal combustion engine, which ensures the reduction of nitrogen oxides to environmentally safe nitrogen molecules.

Tests conducted on the automobile gasoline engine at a test bench in the internal combustion engine testing laboratory demonstrated that, with the participation of hydrogen atoms in the exhaust pipe of the internal combustion engine, radical-chain reactions for the reduction of nitrogen oxides proceed actively without a heterogeneous catalyst containing precious metals.

The results of bench tests on the neutralization of nitrogen oxides in exhaust gases using atomic hydrogen were analyzed, on the basis of which it was established that the described method for neutralizing nitrogen oxides is viable, and that continued research in this area is promising.

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Literature

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