

Design and Fabrication of Emission Control Attachment for Catalytic Converter

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ABSTRACT: In now a days there are many reasons of air pollution. The most reason of air pollution are industries and automobiles. The diesel engine Vehicles produces more air pollution. Due to combustion of fuel the toxic gases emits exhaust like CO, HC and NOX. So the catalytic converter is introduced to reduce the air pollution. It's work is to convert harmful pollutants (CO, HC, NOX) into less harmful emissions (N₂, CO₂, H₂O) before the even leave the exhaust. The unburned fuel (or) contaminants entering the converter can cause heat. This excessive heat can melt honey comb support may be break and cause a rattle. So we can introduce emission control attachment for to overcome those problems. This arrangement is fixed before the catalytic converter.

I. INTRODUCTION

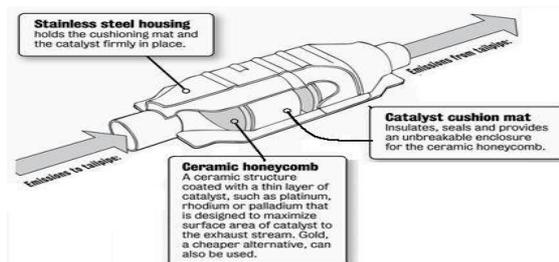
A catalytic converter is a device used to reduce the toxicity of emissions from an internal combustion engine. First widely introduced on series production automobiles in the U.S. market for the 1975 model year to comply with tightening EPA regulations on auto exhaust, catalytic converters are still most commonly used in motor vehicle exhaust systems.

The catalytic converter was invented by Eugene Houdry, a French mechanical engineer and expert in catalytic oil refining who lived in the United States. About 1950, when the results of early studies of smog in Los Angeles were published, Houdry became concerned about the role of automobile exhaust in air pollution and founded a special company, Oxy-Catalyst, to develop catalytic converters for gasoline engines - an idea ahead of its time for which he was awarded a patent (US2742437).

Widespread adoption had to wait until the extremely effective anti-knock agent tetra-ethyl lead was eliminated from most gasoline over environmental concerns, as the agent would "poison"the converter by forming a coating on the catalyst's surface, effectively disabling it. The catalytic converter was further developed by John J. Mooney and Carl D. Keith at the Engelhard Corporation, creating the first production catalytic converter in 1973.

II. CATALYTIC CONVERTER

A steel housing provides protection and structure support for substrate; insulation material (mat or wire mesh) provides heat insulation and support between steel housing and substrate; seals are there to protect mat material from been burned by the exhaust gas.



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III. LITERATURE REVIEW CHIRAG M. AMIN, ETAL

Exhaust emissions of much concern are Hydrocarbon (HC), Carbon Monoxide (CO) and Nitrogen Oxide (NO_x) from the automotive vehicles.

Catalytic converter oxidizes harmful CO and HC emission to CO₂ and H₂O in the exhaust system and thus the emission is controlled.

There are several types of problems associated with noble metal based catalytic converter.

These factors encourage for the possible application of non-noble metal based material such as copper as a catalyst, which may by proper improvements be able to show the desired activity and can also offer better durability characteristics due to its poison resistant nature.

The present work is aimed at using copper as a catalyst for catalytic converter. Wire mesh copper catalytic converter is developed for a volume of 1.54 m³. The experiment is carried out on four stroke single cylinder CI engine. The optimum values of exhaust emissions found at full load are HC (130 ppm), CO (0.07 %). By using copper based catalytic converter it is found that HC is reduced by 38 % and CO by 33 % at full load.

MR KULDEEP D PATEL, EATAL

The purpose of this paper is to present Air pollution generated from mobile sources is a problem of general interest. Vehicle population is projected to grow close to 1300 million by the year 2030.

Due to incomplete combustion in the engine, there are a number of incomplete combustion products CO, HC, NO_x, particulate matters etc.

These pollutants have negative impact on air quality, environment and human health that leads in stringent norms of pollutant emission.

Numbers of alternative technologies like improvement in engine design, fuel pre-treatment, use of alternative fuels, fuel additives, exhaust treatment or better tuning of the combustion process etc.

They are being considered to reduce the emission levels of the engine. Among all the types of technologies developed so far, use of catalytic converters based on platinum (noble) group metal is the best way to control automotive exhaust emissions.

This review paper discusses automotive exhaust emissions and its impact, automotive exhaust emission control by platinum (noble) group metal based catalyst in catalytic converter, history of catalytic convertor, types of catalytic convertor, limitation of catalytic convertor and also achievements of catalytic convertor.

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M. BALENOVIC, EATAL

Though very important for the system performance, the dynamic behavior of the catalytic converter has mainly been neglected in the design of exhaust emission control systems.

Since the major dynamic effects stem from

the oxygen storage capabilities of the catalytic converter, a novel model-based control scheme, with the explicit control of the converter's oxygen storage level is proposed. The controlled variable cannot be measured.

It has to be predicted by an on-line running model (inferential sensor). The model accuracy and adaptability are therefore crucial.

A simple algorithm for the model parameter identification is developed.

All tests are performed on a previously developed first principle model of the catalytic converter so that the controller effectiveness and performance can clearly be observed.

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P.KARUPPUSAMY, EATAL

Now a days the global warming and air pollution are big issue in the world. The more amount of air pollution is due to emissions from an internal combustion engine.

Catalytic converter plays a vital role in reducing harmful gases, but the presence of catalytic converter increases the exhaust back pressure.

This paper deals with the catalytic converter designed and through CFD (Star CCM+ software) analysis, a compromise between two parameters namely, more filtration efficiency with limited back pressure was aimed at.

In CFD analysis, various models with different wire mesh grid size combinations were simulated using the appropriate boundary conditions and fluid properties specified to the system with suitable assumptions.

The back pressure variations in various models and the flow of the gas in the substrate were discussed in.

Finally, the model with limited backpressure was fabricated and Experiments were carried out on computerized kirloskar single cylinder four stroke diesel engine test rig with an eddy current dynamometer. The performance of the engine and the catalytic converter were discussed.

IV. PROBLEM IDENTIFICATION

Catalyst poisoning occurs when the catalytic converter is exposed to exhaust containing substances that coat the working surfaces, encapsulating the catalyst so that it cannot contact and treat the exhaust. Any condition that causes abnormally high levels of unburned hydrocarbons — raw or partially- burnt fuel — to reach the converter will tend to significantly elevate its temperature, bringing the risk of a meltdown of the substrate and resultant catalytic deactivation and severe exhaust restriction .

Some early converter designs created a great deal of restriction to the flow of exhaust, which negatively affected vehicle performance, drivability, and fuel economy .It had been stated that catalytic converters are known in a lot of cases to have an excessively long warm-up time period, in a great deal of cases ranging up to thirty-minutes.

V .EXPRIMENTAL SETUP



The emission control attachment consists of several numbers of copper plates. These plates are arranged in particular manner. The first copper plate is placed in 60° to the axis of flow of the exhaust gas. The second copper plate is placed in 20° to the axis of flow of the exhaust gas. The third copper plate is placed in 45° to the axis of flow of the exhaust gas. The dimension of copper plate is 14.5cm in length, 12cm in width and 2mm in thickness. The radius of the arcs at the corners of plate 5cm which is used to reduce the temperature and velocity of exhaust gas.

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Finally the process is closed by welding process. The two thermocouples fixed at the inlet and outlet of the emission control attachment which is used to measure the temperature of the exhaust gas from the diesel engine.

The emission control attachment is fixed before the catalytic convertor. The connector is used to connect the emission control attachment and the outlet pipe from the exhaust of the diesel engine.

WORKING

Start the diesel engine and left in running position for some time. The glass fiber filter paper is fixed at the end of the arrangement for to analyze the composition and properties of the exhaust gas (composition of hydrogen, nitrogen oxides and carbon-di-oxide) without the emission control attachment.

Then the emission control attachment is fixed in between the outlet of the diesel engine exhaust and the catalytic convertor. The temperature of the exhaust gas was measured by the thermocouple which was placed before the emission control attachment.

The temperature and the velocity of the exhaust Gas was reduced by the striking effect on the copper plates present on the emission control attachment. After the reduction the exhaust gases was coming out and the temperature of those was measured by the application of thermocouple present at the edge of the arrangement. Due the reduced velocity and temperature of the exhaust gas the catalytic converter works efficiently.

VI. RESULT AND CONCLUSION

The Design and Fabrication of Attachment of Emission Control for Catalytic Controller was successfully completed as per the designed specification. The trial performance of this device provides to be successful, with case of operation and safety, hence the results has given a clear indication of its commercial viability. The cost analysis has shown its economic feasibility and we are under the impression that it can be further reduced, when produced on a mass scale

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