

Use of Lime & Cobalt Oxide as Catalyst on Combustion Ignition Engine

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Abstract— In today’s world, the population of vehicle is increasing day by day and the pollutant release by them are NOx, CO, HO which result for several respiratory disease. So, it become necessary to vanish this by product by providing pre exhaust or after exhaust treatment. Number of alternative technologies like improvement in engine design, fuel pretreatment, fuel additives, exhaust treatment of better turning of the combustion process are been considered to reduce the emission level of the engine. This review paper discusses automotive exhaust emission and its impact on environment and controlling the emission of harmful gases with the use of catalyst such as lime and sum more additive like cobalt oxide etc, history of catalytic, use of catalytic, process use up to now, limitation of catalytic and achievement of catalytic.

Keywords: Catalyst, Oxidation And Reduction Process, Exhaust Emissions, Gas Metal, Analyzer

I. INTRODUCTION

In a search, it is shown that 1300 million of vehicle population is to grow by 2030 and the release of harmful gases due to incomplete combustions that are CO, HC, NOx, particulate matters etc. The pollutants have undesirable effect on air quality, environment and human health that tips in stringent norms of pollutant emission. Generation of high power vehicle by introducing new technology which result in carrying undesirable effects apart from its broad application and use. Increase in the demand of vehicles also increases the harmful contents in the air. Most vehicular transportation relies on combustion of gasoline, diesel and jet fuels with emission of (CO), unburned (HC), (NOx) and particulates matter (PM) are concern. Due to combustion efficiency less than 100% HC & CO are release and the NOx is release due to high temperature (>1500 Oc). Considering normal engine operating conditions are: (CO, 0.5 vol.%), unburned (HC, 350 vppm), (NOx, 900 vppm) (H2, 0.17 vol.%), (H2O, 10 vol.%), (CO2, 10 vol.%), (O2, 0.5 vol.%). Carbon monoxide is a noted poison which lead to reduce mental acuity for some individuals. HC and NOx lead to photochemical smog in presences of sunlight give secondary pollutant ozone, nitro dioxide & peroxyacyl nitrate which cause also global environmental problems.

Silencer in the vehicle from where exhaust gas releases to the atmosphere containing HC, NOx, CO. now a days catalytic convertor are inserted in the silencer to demolished harmful gasses into CO2, H2O, N2 and O2 which are not harmful and it is necessary to all the vehicles.

II. HISTORY

NOx gas coming out from the commercial vehicle should be vanished. Now days catalytic converter are used. Eugene Houdry, a French mechanical engineer invented catalytic convertor, expert in catalytic oil refining who lived in the U.S. around 1950. When the results of early studies of smog in Los Angeles were published, that the use of vehicle increases release of harmful gasses increase which lead to concerned,

hondry founded a company, Oxy-Catalyst. Houdry formed catalytic converters for smoke stacks. Then he developed catalytic converters for warehouse fork lifts which used gasoline. in the mid-1950s he began to research catalytic converters for CI engines.

Widespread adoption of catalytic converters didn’t occur until more stringent emission control regulations forced the removal of the anti-knock agent, tetraethyl lead, from most gasoline, because lead was a ‘catalyst poison’ and can damage the converter by forming a coating on the surface, effectively disabling it. Catalytic converters was made by a engineers including John J. Mooney and Carl D. Keith at the Engelhard Corporation, it was the first production catalytic converter in 1973.



Fig. 2.1: catalytic convertor

III. CATALYTIC CONVERTOR

A catalytic converter (CC) is inserted into the silencer through which harmful exhaust gases containing unburnt fuel, CO, NOx are released. The function of the catalytic converter is to convert these gases into CO2, water, N2 and O2 and currently, it is compulsory for all automobiles plying on roads. In India the government has made catalytic converters compulsory in all type of vehicles. Catalyst is carried by washcoat. Aluminum oxide, titanium dioxide, silicon dioxide, or silica and alumina can be used as catalyst. The materials of washcoat to form a rough, irregular surface, which increases the surface area compared to the smooth surface of the bare substrate. This occur maximum catalytic activity surface available to react. The coat must sustain its surface temperature (1000°C) and prevent sintering of the catalytic metal.

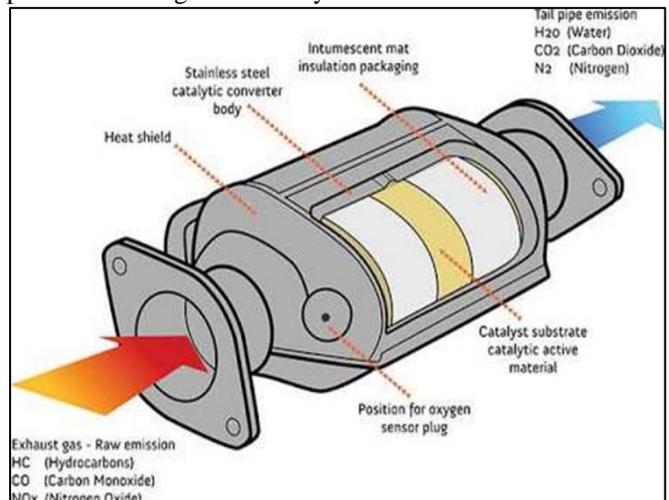
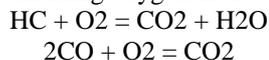


Fig. 3.1: diagram of catalytic convertor

IV. TYPES OF CATALYTIC CONVERTOR

A. The Oxidization Catalytic Converter

An oxidation catalyst placed on the silencer of a vehicles and it is the second stage of the catalytic converter. It decreases the HC and CO by burning them over a platinum and palladium catalyst. This catalyst occur the reaction of the CO and HC with the remaining oxygen in the exhaust gas.



B. The Reduction Catalytic Converter

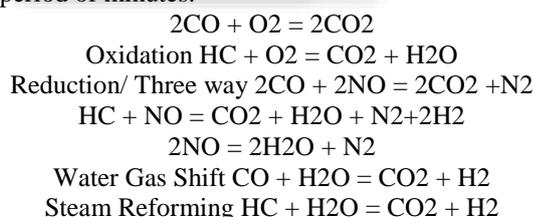
A reduction catalyst is use to control NO_x as a distinct system to the oxidation catalytic converter and it is the first stage of the catalytic converter. It uses platinum and rhodium to decrease the NO_x emissions. Here the catalyst rips the nitrogen atom out of the molecule and holds on to it, freeing the oxygen in the form of O₂. The atoms of nitrogen made bond with other nitrogen atoms that are also inserted to the catalyst forming N₂.



C. The Three Way Catalytic Converter (TWCs)

TWCs performing the oxidation of CO, HC and the reduction of NO_x simultaneously. Noble metals are used as the active phase in TWCs. Pd is by far the inexpensive noble metal in the market and has selectivity and activity for HC. Rhodium the other constituent of three-way catalysts is recognized as the most efficient catalyst for the reduction of NO to N₂. The efficiency of TWCs get affected by operating the catalyst at temperatures greater than 600°C.

The reactions are the oxidation of CO and HC and the reduction of NO_x. Intermediate products such as N₂O and NO₂ are also originated. The NO_x storing concept is based on combination of a storage component into the three-way catalyst (TWCs) to store NO_x during lean conditions for a time period of minutes.



V. CATALYST

Catalyst include oxides of base metals e.g. copper, chromium, nickel, cobalt etc. and the noble metals platinum (Pt), palladium and rhodium. Base metal oxides found to be effective at higher temperature but they moled and deactivate when subjected to high end exhaust gas temperature of Spark-Ignition engine operation. The conversion efficiency is severely inhibited by Sulphur dioxide resulting from Sulphur in fuel. The base metal catalysts are required in a large volume and at high thermal inertia they took longer to heat up to operating temperature. In practice only the noble metals are used because they have high specific activity high resistance to thermal degradation, Superior cold start performance and low deactivation caused by fuel Sulphur.

VI. LIMITATION

Early converter designs restricted the flow of exhaust, which affected vehicle performance, drivability, and fuel economy. Since they were used with carburetors incapable of fuel air mixture control which over heat, and set fire to flammable materials under the vehicle.

Removing a modern catalytic converter in new condition will not increase vehicle performance without retuning, but their removal or “gutting” continues. The converter may be replaced by a section of ordinary pipe carrying catalyst meant to check if the converter is clogged by comparing how the engine runs with versus without the converter, which reinstallation of the converter in order to pass an emission test.

Vehicles without catalytic converters fail emission inspections. The automotive supplies high-flow converters for vehicles for demolishing harmful gasses.

VII. CONCLUSION

- Environmental, ecological and concern result in increasingly stringent emissions regulations of pollutant emission from vehicle engines.
- Among all the types of technologies developed so far, use of catalytic converters is the best way to control auto exhaust emission.
- The economical reasons, limited resources of platinum group metal and some operating limitations of platinum group metal based catalytic converters have motivated the investigation of catalyst material.
- This type of Catalytic converters has also been developed for use on trucks, buses and motorcycles as well as on construction equipment lawn and garden equipment marine engines and other non-road engines.
- Catalytic converters are used to reduce emissions from vehicles, fuel powered by natural gas, methanol, ethanol and propane.
- In India, all the vehicles are required to have the catalytic converter ordered by the govt. of India.
 - Acronyms
 - CO Carbon monoxide
 - HC Hydrocarbons
 - NO_x Nitrogen oxides
 - PM Particulates matter
 - TWC Three way catalytic convertor
 - Rh Rhodium
 - Pt Platinum
 - Pd Palladium

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