

# Used of Catalytic Converter for Automotive Exhaust Emission

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**Abstract**— In today's world. Air pollution generated from mobile sources is containing the pollutants which are hydrocarbons (hc), carbon monoxide (co), and nitrogen gases (nox). These air pollutants are harmful to plants and animals, as well as creature. Number of alternative technologies is used to reduce the harmful emission like improvement in engine design, fuel pre-treatment, use of alternative fuels, fuel additives, exhaust treatment or better tuning of the combustion process etc. among all the types of technologies use of catalytic converters is the best way to control automotive exhaust emissions. This review paper discusses the need to control engine emissions & used of catalytic converter to reduce the emission levels of the engine. As well as review paper discusses about history of catalytic converter, types of catalytic converter, limitation of catalytic converter and also achievements of catalytic converter.

**Keywords:** Automotive Exhaust Emission, Catalytic Converter

## I. INTRODUCTION

Air pollution generated from mobile sources like cars contributes major air quality issues in rural yet as urban and industrial areas in each developed and developing countries. About fifty million cars are unit created once a year and over 700 million cars are unit used worldwide. Vehicle population is projected to grow about to 1300 million by the year 2030. 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) (h<sub>2</sub>, 0.17 vol.%), (h<sub>2</sub>o, 10 vol.%), (co<sub>2</sub>, 10 vol.%), (o<sub>2</sub>, 0.5 vol.%). the reduction of harmful substances emission from the combustion is seen within the sort of 2 measures: . primary measures (inside engine): here many alternative technical strategies are unit went to cut back the exhaust emission i.e. combustion of lean air fuel mixture, exhaust gas recirculation etc. .Secondary measures (outside cylinder): once the first measures are unit used, there is an oxidation, reduction, and 3 way catalytic converter based on adsorption procedure. This enables the reduction of co, hc, and Nox that's fascinating.

## II. HISTORY

The catalytic converter was invented by Eugene Houdry, a French mechanical engineer who lived in the United States. In 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 attained a patent (US2742437). But, until the extremely effective anti-knock agent tetra-ethyl lead was eliminated from most gasoline over environmental concerns, it would

"poison" the converter by forming a coating on the catalyst's surface, effectively disabling it. The catalytic converter was later on further developed by John J. Mooney and Carl D. Keith at the Engelhard Corporation creating the first production catalytic converter in 1973. Beginning in 1979, a mandated reduction in nox required the development and use of a three way catalyst for co, hc and nox abatement. Catalytic converter has gone through many processes and remarkable evolution for the past 30 years. It is said to be one of the most effective tools to fight against the overwhelming pollutant contents in our environment, as it reduces almost 80% of the harmful gases resulting from the incomplete combustion of the engine. Catalytic converter is a stainless steel container mounted somewhere along the exhaust pipe of the engine and inside the container is a porous ceramic structure through which the exhaust gas flows (V. Ganesan). In most converters, the ceramic is a single honeycomb structure with many flow passages. The passages comprise of many shapes, including square, triangular, hexagonal and sinusoidal. Early converters used loose granular ceramic with the gas passing between the packed spheres. Since it is difficult to keep the spheres in place, many converter developers opted for ceramic monolith which offers various advantages. Among these advantages are smaller volumes, lower mass and greater ease of packaging.

## III. CATALYTIC CONVERTOR

A catalytic converter is an emissions control device that converts toxic gases and pollutants in exhaust gases to less toxic pollutants by catalyzing a redox reaction (an oxidation and a reduction reaction). Catalytic converters are used with combustion engine oxyacetylene by either hydrocarbon (gasoline) or diesel- together with lean burn engines furthermore as fuel heaters and stoves. The converter is placed within the tail pipe through that deadly exhaust gases containing unburnt fuel, co, nox etc. are emitted. The perform of the converter is to convert the pollutants into dioxide, water, n<sub>2</sub>, o<sub>2</sub>, these are less harmful gases. a mixture of residual amount of hc, co, Roman deity are left over once combustion, consequently, a converter uses valuable like - noble metal (pt), metallic element (pd) as a catalyst to convert harmful pollutants into less harmful gases like- dioxide, o<sub>2</sub>, h<sub>2</sub>o etc. although chemical action converters are most ordinarily applied to exhaust systems in cars, they're conjointly used on electrical generators, forklifts, mining instrumentality, trucks, buses, locomotives and motorcycles. They are conjointly used on some wood stoves to manage emissions. This is sometimes in response to government regulation, either through direct environmental regulation or through health and safety rules.



#### IV. TYPES OF CATALYTIC CONVERTOR

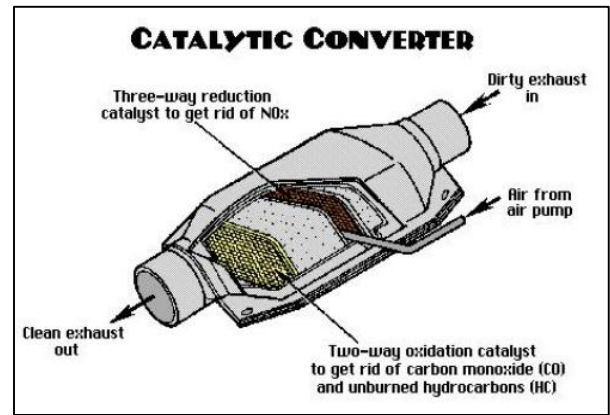
Generally convertor area unit classified into 2 classes –

Two –way: - a 2-way (or "oxidation", generally referred to as associate "oxi-cat") convertor has 2 coincidental tasks: one. oxidation of carbon monoxide to carbon dioxide:  $2\text{co} + \text{o}_2 \rightarrow 2\text{co}_2$  2. Oxidation of hydrocarbons (unburned and partly burned fuel) to dioxide and water:  $\text{cxh}_{2\text{x}+2} + [(3\text{x}+1)/2] \text{o}_2 \rightarrow \text{xco}_2 + (\text{x}+1) \text{water}$  (a combustion reaction) this kind of chemical process convertor is wide used on diesel engines to cut back organic compound and carbon monoxide gas emissions. They were conjointly used on hydrocarbon engines in American- and canadian-market vehicles till 1981. Because of their inability to regulate oxides of chemical element, they were superseded by three-way converters.

three – way:- 3-way chemical process converters (two) have the extra advantage of dominant the emission of gas and dioxide (both along abbreviated with Nox and to not be confused with element oxide), which are precursors to acid rain and smog. since 1981, "three-way" (oxidation-reduction) catalytic converters have been used in vehicle emission control systems in the united states and Canada; several alternative countries have conjointly adopted demanding vehicle emission laws that in impact need multilateral converters on gasoline-powered vehicles. The reduction and oxidization catalysts area unit usually contained in a very common housing; but, in some instances, they may be housed separately. A three-way catalytic converter has three simultaneous tasks:

- 1) Reduction of nitrogen oxides to nitrogen and oxygen:  $2\text{nox} \rightarrow \text{xo}_2 + \text{n}_2$
- 2) Oxidation of carbon monoxide to carbon dioxide:  $2\text{co} + \text{o}_2 \rightarrow 2\text{c}$
- 3) Oxidation of unburnt hydrocarbons (hc) to carbon dioxide and water:  $\text{cxh}_{2\text{x}+2} + [(3\text{x}+1)/2] \text{o}_2 \rightarrow \text{xco}_2 + (\text{x}+1) \text{h}_2\text{o}$ .

These 3 reactions occur most expeditiously once the convertor receives exhaust from associate engine running slightly higher than the ratio purpose. For gasoline combustion. This quantitative relation is between fourteen.6 and 14.8 elements air to 1 half fuel, by weight.



#### V. COMPONENT OF CATALYTIC CONVERTER

##### A. Catalyst:

These embrace oxides of base metals e.g. copper, chromium, nickel, cobalt etc. and the noble metals Pt (pt), metallic element (Pd) and metallic element (rh). Base metal oxides although found to be effective at higher temperature but they sinter and deactivate when subjected to high-end exhaust gas temperature of conventional si (spark- ignition) engine operation.

##### B. Substrate or Support:

###### 1) Pellets:

The primary chemical change converters of traveler cars in early Seventies used a bed of spherical ceramic pellets. These are referred to as packed bed convertor. The spherical pellets made of  $\gamma$ -alumina ( $\gamma - \text{al}_2\text{o}_3$ ). The material of pellets is chosen to possess a high mechanical strength against crush and abrasion.

###### 2) Stone:

In our daily observe a monolith could be a ceramic block consisting of an outsized range of tiny straight and parallel channels. A special mixture of clay binders and additives is pushed through a sophisticated dye to create the monolith structure.

###### 3) Wash Coat:

A thin layer of inorganic oxides known as wash coat is applied to the cells in monolith structure to increase effective surface area for dispersion of active catalyst that increase its contact with the reacting gases.

#### VI. LIMITATION

- 1) Within the exhaust stream with temperatures up to a thousand °C the metal within the catalyst is susceptible to deactivation by sintering, resulting in a discount in extent and hence catalytic activity.
- 2) Noble metal used as catalyst have high value and additionally volatilized at heat.
- 3) Atomic number 46 additionally used as catalyst with the noble metal having less ability of absorption and natural process of element.
- 4) 3 – Method convertor greenhouse gas, that is additionally harmful for the surroundings.

## VII. APPLICATION OF CATALYTIC CONVERTER

- 1) A converter could be a device wont to scale back the toxicity of emissions from an interior combustion engine.
- 2) chemical action converters area unit most typically employed in motorized vehicle exhaust systems.
- 3) chemical action converters are used on generator sets, forklifts, mining instrumentality, trucks, buses, trains, and alternative engine-equipped machines.
- 4) A converter provides AN surroundings for a chemical change whereby cytotoxic combustion by-products area unit born-again to less-toxic substances.

## VIII. CONCLUSION

Three-way catalyst with ratio engine management systems stay the state of art methodology for at the same time dominant organic compound, co and Nox emissions from vehicle. Due to high value of atomic number 78 and operative limitation atomic number 78 based mostly converter motivates the investigators of different catalyst material, that have low coast and supply high potency. Catalytic converter is best choice for reducing the waste product. It is essential for investigation and modification in chemical action to extend the potency of converter.

today's vehicles area unit meeting emission standards that need reductions of up to ninety nine of hc, co and Nox compared to the uncontrolled levels of vehicles sold within the Sixties. Environmental, ecological and health concern end in more and more tight emissions laws of waste product emissions from vehicle engines. Use of metal monolith type catalytic converters is the best way to control the auto exhaust emissions. The economic reasons, limited resources of platinum group (noble group) metal and some operating limitations of platinum group metal based catalytic converters have motivated towards the investigation of alternative catalyst materials. this type of chemical action converters have additionally been developed for the employment on trucks, buses and motorcycles as well as on construction equipment lawn and garden equipment etc. in 2005, 100 percent of the new cars sold within the u.s. were equipped with a converter , and worldwide over ninetieth of the new cars sold had a metal stone sort catalyst.

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