

# Modified Catalytic Converter Using Nano Copper and Silver Composite Coating

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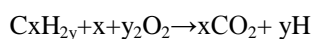
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**ABSTRACT:** One of the engineering technologies that can be used to reduce air pollution is the use of catalytic converter mounted on vehicle gas exhaust duct. Unfortunately, these tools are very expensive in the market and not all motor vehicles use these technologies, because the catalyst was made from expensive metals and rarely available in the market, such as: Palladium, Platinum and Rhodium. Besides, the catalyst is susceptible to premium fuel with low levels of lead (Pb) which results in the damage of the function of the catalyst due to blockage in the honeycomb Catalytic Converter. Therefore research needs to be done in the laboratory to test the other substrate materials as a catalyst, to study the ability of the catalyst in a catalytic converter to reduce exhaust emissions of Carbon Monoxide. This research will also study the performance capabilities and assess the effectiveness of silver-coated Copper catalysts which are designed in such a way to obtain the appropriate shape and type of Catalytic Converter catalyst and suitable for premium fuel motor vehicles. The result showed that Catalytic Converter design and modification of catalytic materials can be an alternative to overcome the high air pollution problem from the transportation sector, especially particular Carbon Monoxide exhaust emissions from gasoline motors. The use of silver-Coated Copper as a catalyst in the catalytic converter was significantly able to increase the reduction of Carbon Monoxide exhaust emissions. The increase of catalyst cells amount decreased the concentration of Carbon Monoxide exhaust emissions. Optimum Design of Model Catalytic Converter was able to reduce exhaust emissions of Carbon Monoxide.

**KEYWORDS:** Nano particles, Pollution reduction, Catalytic converter, Four stroke engine

## I. INTRODUCTION

The use of catalytic converter to reduce emission from vehicle exhaust has been recently. Mostly the catalytic converter used for motor vehicles (on the market) is in a type of pellet and monolithic catalysts and the materials made from noble metals, such as palladium (Pd), Platinum (Pt) and Rhodium (Rh). Those metals have a high specific activity, a large degree of volatility, easily oxidized and easily broken at temperature of 500-900<sup>0</sup>C, which result in reducing activity of the catalyst. Besides these metals have a low availability and quite expensive. IN a general internal combustion engine, hydrocarbons are burned with an oxidizer. The heat release results in an increased pressure in the cylinder, which is then converted to mechanical energy through the pistons. The products of the desired complete combustion are carbon dioxide (CO<sub>2</sub>) and water (H<sub>2</sub>O).

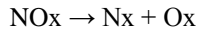


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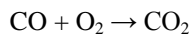
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Vol. 5, Issue 10, October 2016

In catalytic converter



Oxidation of carbon monoxide to carbon dioxide.



Oxidation of hydrocarbons into carbon dioxide and water.

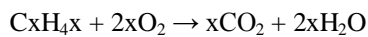


Fig. 1 :Cut section of catalytic converter

This study aims to design or to create a tool to reduce exhaust emissions of motor vehicles often called as catalytic converter in variation of Silver-Coated Copper Catalyst. This tool is particularly to reduce exhaust emissions of carbon monoxide and to find optimum design.

Why nano copper?

1. The use of platinum, palladium and rhodium are very expensive because of scarcity of these metals.
2. Rhodium and palladium is the big contributors to smog.
3. Copper is low cost catalyst composition and has superior durability than platinum and palladium.
4. The emission will be reduced due to increased surface area for catalysis.
5. Better poison resistance and suitable reactor design for low pressure drops and improved performance.

## II. METHODOLOGY

### Preparation of nano copper

The nano-copper is prepared by using copper sulphate anhydrous and ascorbic.



Fig. 2.1 :Nano copper prepare

## Characterization of nano copper

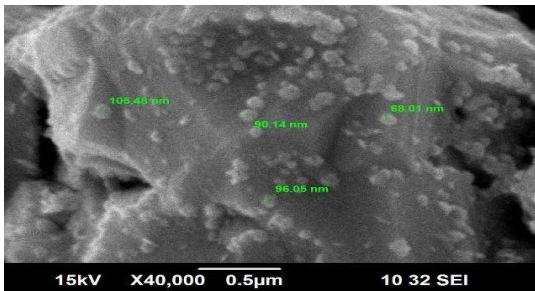


Fig. 2.2 :SEM Image of nano copper

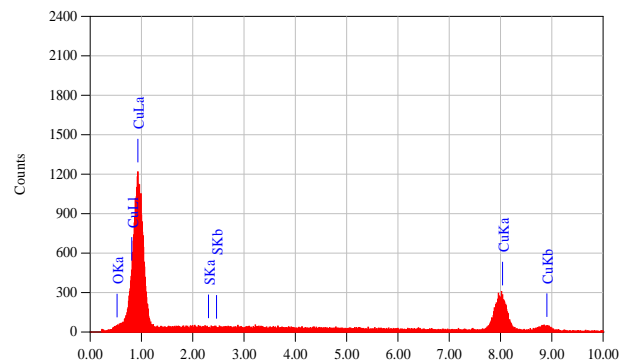


Fig. 2.3 : EDAX of nano copper

## Preparation of nano silver

As a source of silver ions, silver nitrate was used (analytically pure) and gelatin (analytically pure) served as a stabilizer. Ascorbic acid (analytically pure) was used as a reducing agent.

## Characterization of nano-silver

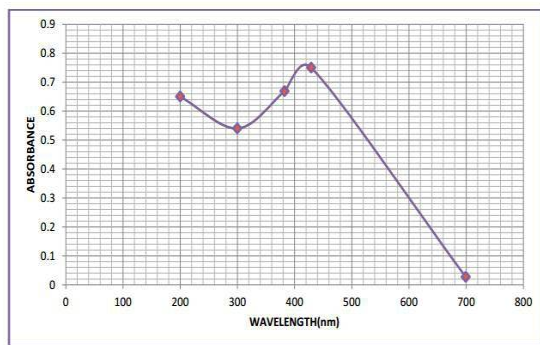


Fig. 2.4 : UV-VIS absorption spectra of the silver nano particles.

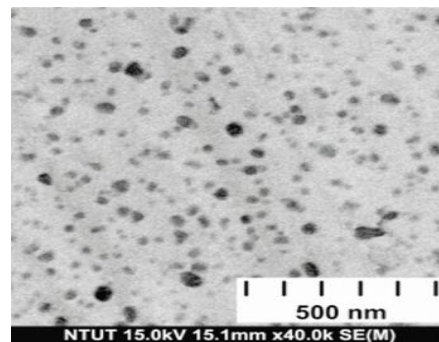


Fig. 2.5. : SEM image of nano silver

## Modification of catalytic converter

1. The catalytic chamber in open using arc welding and cutting.
2. Inside the converter nano copper-silver composite is coated.
4. Then the converter is welded back to original shape.



Fig.2.6 :Nano copper coated catalytic converter

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Vol. 5, Issue 10, October 2016

## Testing of modified catalytic converter

The experiments were carried out on a four stroke, horizontal air cooled spark ignition engine. Required amount of fuel was added to the fuel tank. The engine was started by spark ignition technique. Start the gas analyser by connecting to battery and put in four stroke E.I.S mode. Made the gas analyser connections to the ordinary converter to check the efficiency. Start the engine, note down the reading. Repeat it for different RPM. Similarly it is done with modified catalytic converter.



Fig. 2.7 : Gas analyser connection to engine



Fig. 2.8 : AVL 422 Gas analyser

## II. RESULTS AND DISCUSSIONS

Sl. No	Speed (rpm)	Ordinary (PPM)		Nano-copper Coated converter (PPM)		Difference (PPM)	
		HC	CO	HC	CO	HC	CO
1	905	43	0.03	37	0.02	6	0.01
2	1490	22	0.05	18	0.04	4	0.01
3	2065	19	0.05	15	0.03	4	0.02
4	2506	8	0.04	6	0.01	2	0.03
5	3046	4	0.08	3	0.04	1	0.04

Table. 1 : Values of Load, CO and HC

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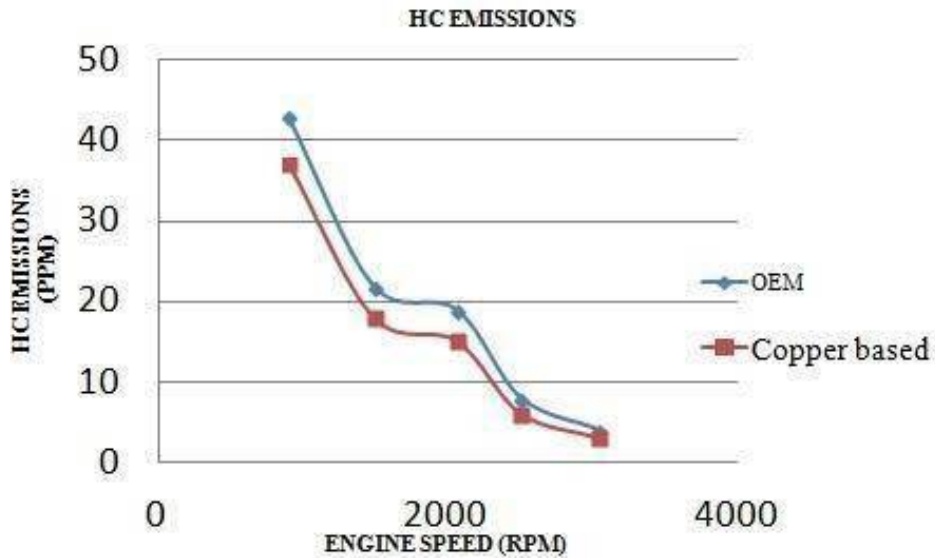


Fig. 3.1 : The variation of HC emission vs engine speed.

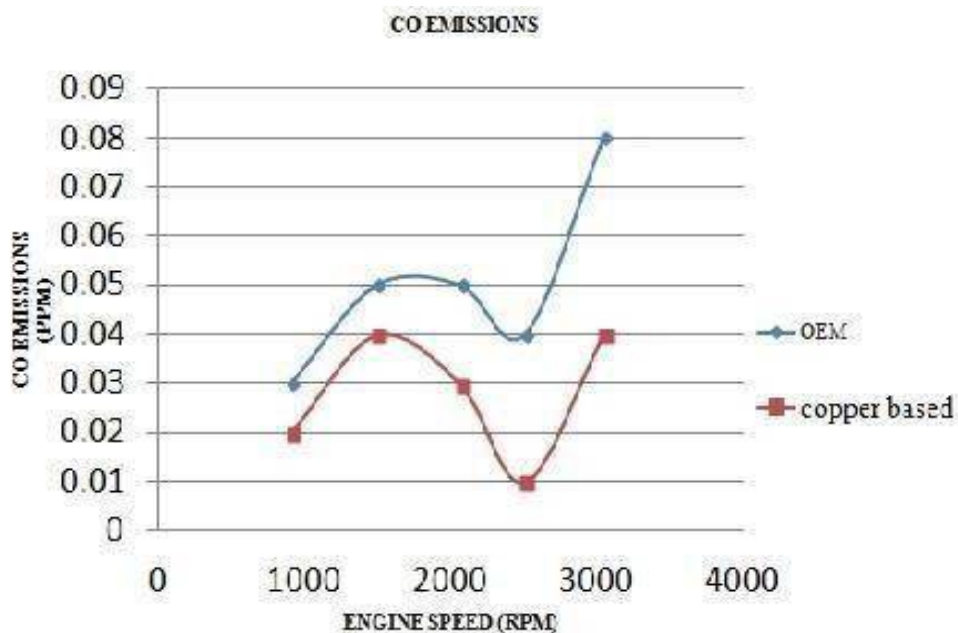


Fig. 3.2 : The variation of CO emission vs Speed.

It was observed that the amount of CO was reduced significantly after the modified catalytic converter was installed. On comparing the results obtained from the gas analyser, the amount of pollutants corresponding to specific RPMs, the values obtained were significantly low in the case of modified catalytic converter.



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Vol. 5, Issue 10, October 2016

## IV. CONCLUSION

The non-noble metal nano copper- silver composite works as a catalyst for the conversion of pollutants in exhaust but with limited proportion. The emission tests that we have conducted clearly demonstrate the effectiveness of nano copper- silver composite as a catalyst for the reduction of harmful gases. Experimental results show that, by using copper- silver composite based catalytic converter and HC was reduced from 19 ppm to 15.8 ppm, CO was reduced from 0.044 ppm to 0.028 ppm. The test results indicate a consistent reduction in all the major pollutants. We have observed a significant decline in the HC and CO emission. Also, the NO<sub>x</sub> and CO<sub>2</sub> emissions were much lower. The reduction in emission are considerable at all engine speeds. The material will serve as a viable alternative to conventional emission control techniques. Our experimental results did not cause any effects associated with backpressure. The test results show that the development of nano copper- silver composite based catalytic converter is feasible. Since it gave satisfactory results for the given operating conditions and reduction of HC and CO emissions. Therefore it is concluded that nano copper- silver composite based catalyst system can be an effective approach in the place of expensive metal based catalytic converter.

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