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ANALYSIS AND FABRICATION OF CATALYTIC CONVERTER USING NANOPARTICLES FOR EMISSION CONTROL

[1] Rahul. M, [2] Murali.R, [3] Ranjithkumar P, [4] Yeswanth L [5] Mr. C. Thiyagu,
[1, 2, 3, 4] Ug Student, [5] Assistant Professor,
[1, 2, 3, 4] Department Of Mechanical Engineering, [5] Mechanical,
[1, 2, 3, 4, 5] Sns College of Engineering,
[1, 2, 3, 4, 5] Coimbatore, India.

ABSTRACT - To reduce the pollution in two wheeler by using nano particles. Here we take titanium oxide as catalyst which act as a pollution controller. At initial stage we choose zirconium, titanium and iron oxide as pollution controlled material. Then with the help of ANSYS CFX solver we came to know that titanium oxide was a better one compare to other two materials. After that buy a titanium oxide plate and put small holes. Then fix the plate in the RX100 bike exhaust valve to check manually. At least we compare the result with and without mixing of the plates in exhaust valve.

1. INTRODUCTION

During the last twenty years, scientists have been looking towards nanotechnology for the answer to problems in medicine, computer science, ecology and even sports. Nanotechnology offers the promise for new solutions and product improvements to a variety of market sectors including materials, electronics, energy, bio-medical, and consumer goods. A great deal of emphasis is placed on the real societal benefits around nanotechnology for energy efficiency, renewable resources, environmental remediation and pollution prevention. In particular, new and better techniques for pollution control are emerging as Nano-particles push the limits and capabilities of technology. In the automotive industry, nanotechnology applications are manifold.

Nano-particles prove to be very effective in the reduction of exhaust emissions primarily due to their small size. To control the exhaust emissions from a four stroke engine, the porous holes of the model are coated with the copper nano-particles so that the rate of reaction can be increased. This paper basically deals with modeling and simulation of a complete system which includes a four stroke engine including a prepared model of catalytic converter. The modeling can be very helpful to predict the mathematical nature of the process of exhaust emission reduction through catalytic converter and predict the results by simulation

2. MATERIALS AND METHODS

There are many types of filter materials are used in internal combustion engine. They are Ceramic monolith, ceramic foam, steel wire meshes, ceramic silicon fiber, porous ceramic honey comb are the few types of filter materials. Out of these filter materials, steel wire mesh is selected as filter material because knitted steel wire mesh material is ranked first for its collection efficiency of particulate matter. The other reasons for its selection are,

- Thermal stability during regeneration.
- Good mechanical properties.
- Long durability.
- Easy availability and less cost

Many types of material often used as catalyst in the recent years. Proton acids are probably the most widely used catalysts, especially for the many reactions involving water, including hydrolyses and its reverse. Multifunctional solids often are catalytically active, e.g. zeolites, alumina, certain forms of graphitic carbon etc. Transition metals such as platinum, palladium, rhodium, iron, silver are often used to catalyses redox reactions.

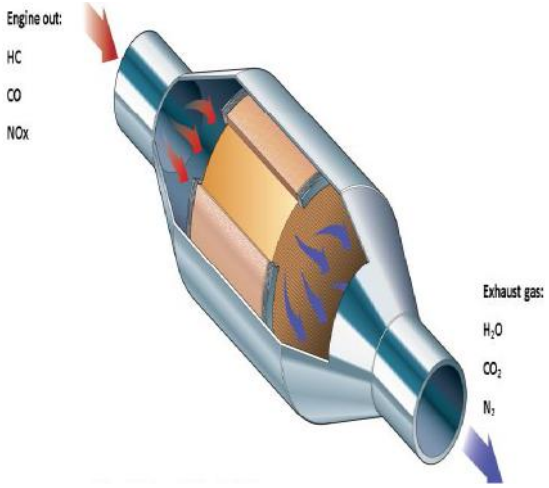
3. METHODOLOGY THREE-WAY CATALYTIC CONVERTER

Three-way catalytic converter is widely used in the automobile industries. The three-way catalytic converter is scheduled to perform three simultaneous tasks

1) Reduction of nitrogen oxides to nitrogen and oxygen $2NOx \rightarrow xO2 + N2$

2) Oxidation of carbon monoxide to carbon dioxide $2CO + O2 \rightarrow 2CO2$

3) Oxidation of unburnt hydrocarbons (HC) to carbon dioxide and water $CxH2x + 2xO2 \rightarrow xCO2 + 2xH2O$

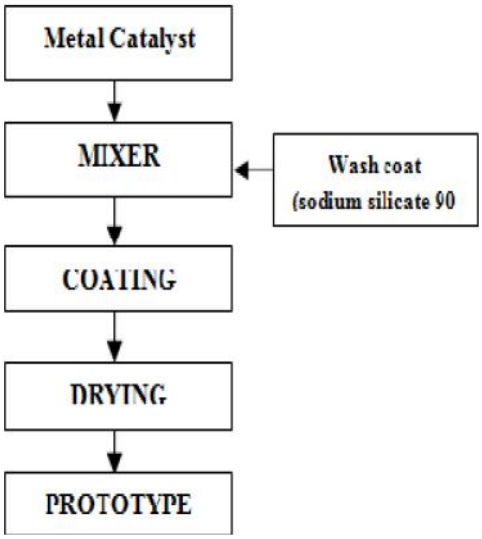


PROCESS OF MANUFACTURE

The process of manufacturing of catalytic converters are illustrated below, First Inlet cone was fabricated for converter housing then exhaust gases from the engine are admitted through inlet cone outlet cone was fabricated. Eco-friendly exhaust gases come out at this end. Cylindrical spacer and two circular housing with provision for putting pellets were fabricated. Pellets of different catalytic materials were developed. The components were assembled and fitted to engine exhaust manifold**.**

NANO COATING METHODS

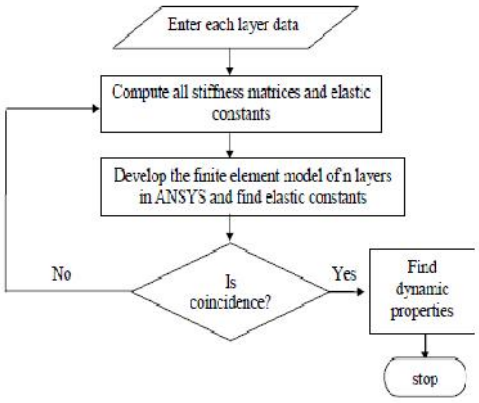
Zinc corrosion products develop naturally on the surface as the coating is exposed to natural wet and dry cycles in the atmosphere and are often referred to as the zinc patina. The zinc patina acts as an additional barrier between the steel and the environment. In addition to the natural barrier protection of the coating and patina, zinc also protects the base steel catholically



COATING PROCESS

Sodium silicate solution was used in wash coat material to increase the coating strength. Ninety grams of sodium silicate solution were added into 10.0 gm of Al2o3 nanoparticles to get 10% Al2o3 nanoparticles slurry. The slurry has been mixed by using a mechanical homogenizer for two hours. Coating of catalyst (Al2o3 nanoparticles slurry) is done by dip coating method, and it has been kept in an oven at 120˚C for 5 hours. Aluminium oxide nano particles, served dual functions: a reduction catalyst and an aluminium substance for the wash coat. Rutile form of Al2o3 was chosen because of its thermal stability from 600◦C and high durability

4. DESIGN METHODOLOGY



The Following general methodologies and best practices can be followed in the modeling of components in CATIA. The Below methodologies and Best practices followed will help in capturing the design intent of the Feature that is to be Modeled and will make the design robust and easy to navigate through

- Specification tree structuring
- Renaming appropriate features & bodies in specification tree
- Handling input data & foreign bodies
- Dimensioning & constraining in sketches
- Parameters and relations.

SPECIFICATION TREE STRUCTURING

The SPECIFICATION TREE is the place where the histories of the features modelled are captured. So it is highly important to have an organized tree structure which gives ease for navigation of the features when any modification takes place.

The SPECIFICATION TREE in a structured manner. The Machining Body features are grouped under one body and base block features in another and so on with appropriate feature operations.

It is also important in structuring the reference and construction element in the tree in an orderly manner.

The points that would be often used (like the Global Origin Point 0, 0, 0,) can be created under Points GEOMETRICAL SET and any reference planes defining legal limits can be created in the planes GEOMETRICAL SET.

RENAMING APPROPRIATE FEATURES & BODIES IN SPECIFICATION TREE

The renaming of features within the design becomes mandatory as it will be useful for the end users to by far identify things for modification.

For instance an end user who wants to identify the M5 holes on the model the SPECIFICATION TREE helps easily in identifying the M5 holes in the model there by making modifications easy.

Also renaming all the features every now and then as it is created will easy things at the Base Block Sketch" and "Base Block" is which will be useful in identifying them at a later stage.

Renaming the Bodies also helps in navigation.

HANDLING INPUT DATA AND FOREIGN BODIES

Any external data that are to be handled in the model can be grouped under a GEOMETRICAL SET called input data which can be used in the model when situation demands.

Some foreign elements like planes, points, curves and surfaces that would be used in the modelling process.

By grouping the foreign elements in a separate GEOMETRICAL SET it is easy to identify them in the SPECIFICATION TREE.

DIMENSIONING AND CONSTRAINING IN SKETCHES

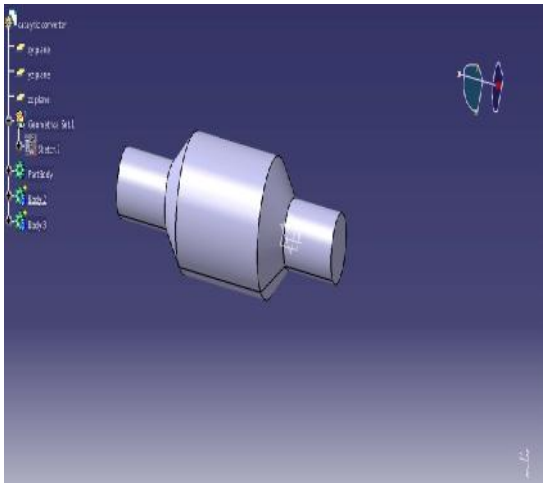
Planes should be intersected in the sketches and made as construction elements and should be used as dimension reference for geometries, this helps in identifying the dimension line clearly in a complex sketch.

Equivalent dimension should be used wherever possible to minimize modification time in the sketches.

Usage of sketch analysis command is mandatory at the end of every sketch build which helps in diagnosing the sketch thereby identifying abnormalities.

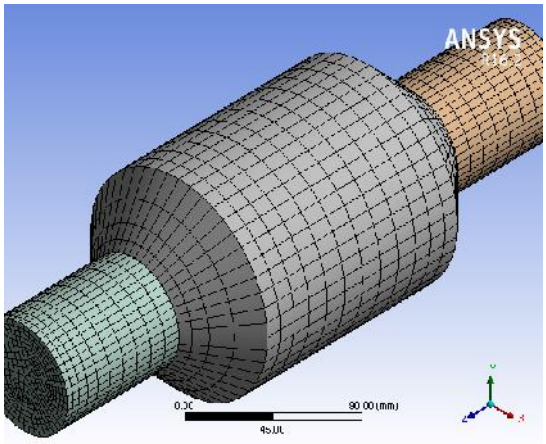
Robust design Intent can be Achieved with the Integration of Parameters and Relations.

CAD MODEL OF CATALYTIC CONVERTER



Meshing of Catalytic Converter

Meshing the catalytic converter is one of the most critical aspects of engineering simulation. Too many cells may result in long Solver runs, and too few may lead to inaccurate results. ANSYS Meshing technology provides a means to balance these Requirements and obtain the right mesh for each simulation in the most automated way possible.



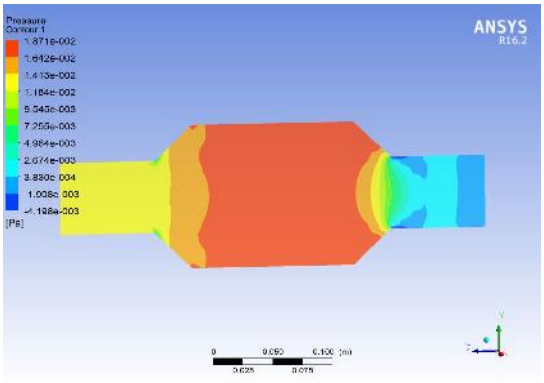
Boundary Conditions for iron oxide Catalytic Converter

Iron-oxides are chemical compounds composed of iron and oxygen. All together, there are sixteen known iron oxides and oxy hydroxides.

5. RESULT ANALYSIS

MATERIALS	VELOCITY	PRESSURE
MATERIAL 1	0.0196m/s	0.0089 Pa
MATERIAL 2	0.1501m/s	0.0134 Pa
MATERIAL 3	0.1801m/s	0.0187 Pa

On comparison of three materials based on velocity and pressure it is observed that material three has highest velocity than the other two materials. Hence it is inferred that the material three has high efficiency than the other materials. titanium oxide pressure analysis



CONCLUSION

According to this Project to controlling pollution in engine exhaust through catalyst converter using many Nanoparticles .The result analysis through ANAYS-CFX solver and comparing these result Titanium oxide which give more velocity means that pollutant of emission gas reducing in porous medium of titanium oxide

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