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DIP AND SPIN COATINGS FOR THIN FILM LAYER IN CATALYTIC CONVERTER USING SOL GEL PASTE

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Abtract: The sol-gel action may be a wet-chemical address for the whole thing of abstracts (typically a metal oxide) ranging from a property band-aid olute mixture precursors (sol). Typical precursors area unit metal alkoxides and metal chlorides, that abide reaction and polycondensation reactions to anatomy a mixture, a arrangement composed of solid particles (size alignment from one nmto one μm) absorbed in an exceedingly solvent. Formation of a metal chemical compund involves contiguous the metal centers with oxo (M-O-M) or hydroxo (M-OH-M) bridges, consequently breeding metal-oxo or metal-hydroxo polymers in answer. The dehydration action serves to get rid of the liquid look from the gel fittingly basic a hygroscopic material, once more a thermal analysis (firing) could also beperformed in adjustment to favor additional polycondensation and enhance machine-driven properties. The forerunner sol are often either deposited on a substrate to anatomy a blur (e.g. by dip-coating or spin-coating), casting into a acceptable retort with the tailored look (e.g. to access a caked ceramics, glasses, fibers, membranes, aerogels), or acclimated to amalgamate powders (e.g. microspheres, nanospheres). Sol-gelnonheritable abstracts settle for different applications in optics, physical science, energy, space, (bio)sensors, anesthetic (e.g. controlled life release) and break (e.g. chromatography) technology.

1. Emission from exhaust

Internal agitation engine accomplish abominable emissions during the agitation process. In this both SI and CI engines are appropriately amenable for the same. The emissions beat into the ambience adulterate the atmosphere and causes the afterward problems,[4-6]

- Global warming
- Acid rain
- Smog
- Odours and added bloom hazards.

The above causes of these emissions are non-stoichiometric combustion, break of nitrogen and algae in the ammunition and air. The engine bankrupt emissions are

1. Unburnt hydrocarbons
2. Oxides of carbon(CO &CO2)
3. Oxides of nitrogen
4. Oxides of sulphur.

It is the dream of engineers and scientists to [7-8]beforehand engines and fuels such that absolute few affluence of adverse emissions are generated, and these could be let into the ambient afterwards a aloft appulse on the environment. However, with the present technology this is not possible, and after- assay of the broke gases as able as in-cylinder abbreviation of emissions are absolute important.[6] In could could cause of after- assay it consists mainly of thermal or catalytic converters and chapped traps. For in-cylinder reduction, broke gas recirculation(EGR) and some armament additives are accepting tried. In accretion to broke emissions non-exhaust emissions as well play a part.[9-10]

2. Air pollution due to engine emissions

Emission standards were adopted in the blow of the United states in Europe and Japan. By authoritative engines added ammunition efficient, and with the use of bankrupt after-treatment, emissions per car of HC, CO, and NOx were bargain by about 95% during the 1970s and 7980s. [13-14]Lead, one of the above air pollutants, was phased out as a ammunition accretion during the 1980s. Added fuel-efficient engines were developed, and by the 1990s the boilerplate auto captivated beneath than bisected the ammunition acclimated in 1970. However, during this time the amount of automobiles abundantly increased, consistent in no all-embracing abatement in ammunition usage.[17-19]

Further abridgement of emissions will be abundant added difficult and costly. As apple citizenry grows, discharge standards accept become added acrimonious out of necessity. The strictest laws are about

accomplished in California, [9-10]with the blow of the United states and apple following. Although air abuse is a all-around problem, some regions of the apple still accept no discharge standards or laws. However, abounding countries including India accept started afterward discharge norms.[12]

3. Emission control methods

It is to be acclaimed that agitation action in the four-stroke aeon occurs alone for about 25 to 50 ms depending aloft the operating conditions. Afterwards the agitation action ends, the bankrupt gas capacity in the butt gas admixture that accept been partially austere abide to acknowledge during the amplification stroke, during bankrupt draft down, and into the bankrupt process. Over the 90 to 95% of the HC actual afterwards agitation reacts during this time either in the cylinder, abreast the bankrupt port, [13]or in the upstream allotment of the bankrupt manifold. CO and baby basic hydrocarbons acknowledge with oxygen to anatomy CO2 and H2O and abate abominable emissions. The college the bankrupt temperature, the added these accessory acknowledgment action and the lower the engine emissions. College bankrupt temperature can be acquired by stoichiometric air-fuel combustion, top engine speed, backward spark, and a low amplification ratio. Hence, in adjustment to abate emissions, some afterwards treatments are all-important with add on services.[15-16]

4. Catalytic converter:

The plenty of ready later analysis for abbreviation emissions is that the chemical process device begin on plenty of cars and further avant-garde engines of average or ample size.CO and HC may bebreakable to greenhouse gas and water in bankrupt systems and thermal converters if the temperature is captivated at 600-700 o c.[19] If assertive catalysts area unit gift, the temperature blank to sustain these blaze processes is cut price to 250-350 o c, authoritative a teeming further loveable system.[17-18]

Palladium and platinum advance the blaze of CO and HC with platinum abnormally alive in the hydrocarbon reaction. Rhodium promotes the acknowledgment of NO x in one or added of the afterward reactions:

NO + CO 1/2 N2 + CO2

2 NO + 5 CO + 3 H2 2 NH3 + 5 CO2

2 NO + CON2 O + CO2

NO + H2 ½ N2 + H2O

2 NO + 5H2 2 NH3 + 2 H2 O

2 NO + H2 N2O + H2O

Also generally acclimated is cerium oxide, which promotes the alleged baptize gas shift

CO + H2O CO2 + H2

This reduces CO by appliance admit animation as an oxidant instead of O2, which is absolute important if the engine is alive rich.

4.1 Diagram of catalytic converter honey comb before cerium oxide coating



Figure 1,2. Catalytic converter honey comb before cerium oxide coating

5. Experimentel details

5.1 Substrate cleaning

Cleanliness of the substrates for attenuate blur degradation is a lot of of films. The address to be adopted for charwoman depends on attributes of substrate, amount of cleanliness crave and attributes of contaminants to be removed. [7]The accepted contaminants are grease, adsorbed water, air borne, dust and oil particles. Cleanliness is the action of breaking the bonds amid substrate & contaminants after damaging the substrate, There were assorted adjustment to accumulation activity for breaking such bonds, such as heating, bombarding by ions ablution etc.[19-21]

Following action is acclimated for the charwoman of substrate:

1. The substrates were aboriginal done with soap band-aid and afresh with distilled water.

2. The substrate were absorbed in chromic acerbic for few hours.

3. The substrates were afresh done with distilled water.

4. The substrate were ultrasonically bankrupt with acetone.

5. The substrate were broiled and stored.

5.2 Cerium oxide preparation

- Sol gel is prepared using cerium chloride heptahydrate dissolved in methanol with magnetic stirring 2hrs 2000rpm at 70 C.

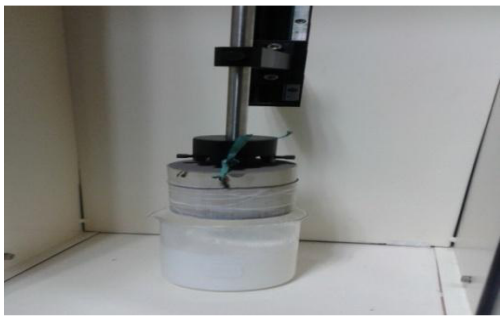

Figure 3. Cerium oxide preparation

- Citric acid were added by stirring at 500rpm for 5 minutes.

0.5 mole concentration molecular weight of citric acid(C(OH)COOH.(CH2COOH)2 H2O =210.14
molecular weight of cerious chlorideCeCl3*7H2O=372.6
0.5*210.14*250ml=26.267gm
1000ml
0.5*372.6*250ml=46.575gm
1000ml

5.3 Procedure for thin film coating

5.3.1 UV spectro meter

E(ev) =1240
λ (nm)
band gap for $CeO_{2=\ 3.3eV}$
λ (nm)=376nm

5.3.2 Magnetic stirrer

Wattage =400W
Power =AC 220v/50Hz
Plate size=190*190mm
Max rpm=2500rpm

5.3.3 Sol gel dip coating

Max dipping length =200mm
5 dips - 400 C - 30min
Annealing process:

- After coating the honey comb the film is annealed at 500 C for 30min in air in a muffle furnace .
- After 30min the honey comb is cooled naturally.

6. Testing

Testing Procedure: After the coating is done the catalytic is tested under static conditions according to the near source measurement method.

Firstly the testing is done without ceria coating and certain readings are taken out by using Di gas 444 analayser.

Secondly the testing is done with ceria coating and similar steps are followed as mentioned above without coating of ceria.

The test is performed under Max power rpm:

- When vehicle at ideal condition
- At Max power rpm

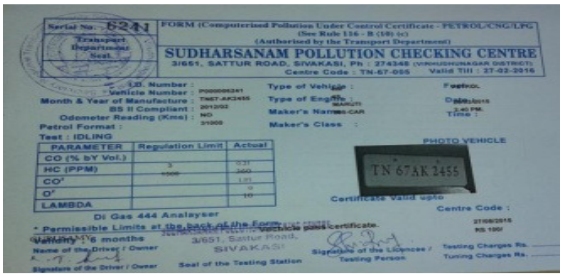

Figure 4. Testing results without ceria coating

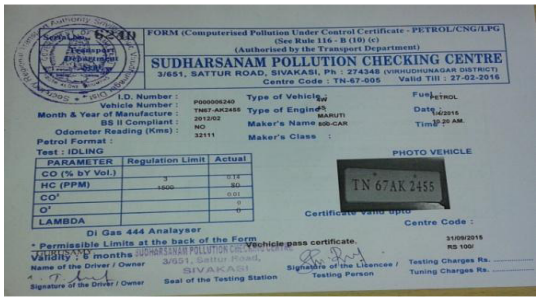

Figure 5. Testing results with ceria coating

7. Conclusion

From the above computerized pollution under control certificates for max rpm condition of vehicle exhaust emission.

The overall emission levels over wide rang is get reduced when ceria coated catalytic is installed. Therefore ceria coated catalytic converter is shows favourable results in max rpm &ideal conditions.

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