ACTIVE NOISE CANCELATION IN AUTOMATIVE MUFFLER

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ABSTRACT:

In Day to day life our environment is getting more and more polluted and it is affected by noisier. Our people also adapted with this harsh environment so we need a new type of absorption material which is adaptive with this environment and which can be used in our vehicles to reduce the amount of noise produce by it. One of the type of abortive material is silicon carbide foam and sound absorption material. For reducing the amount of noise emitted by the exhaust of an internal combustion engine. This noise is reduced as the transmission loss (TL) when the muffler increases. Various types of components are present in the mufflers like foam, sound absorption materials, silicon carbide filter etc., which can reduce the noise. This paper explains about TL characteristics and also different methods.

KEYWORDS : *Silicon carbide foam, fibrous materials, filter*

1.INTRODUCTION:

Over the last decade and half the amount of vehicles are increasing and due to this the amount of noise emitted by the exhaust system of vehicles and emission requirements are also getting more and more. Muffler plays an important role in reducing the exhaust and intake system noise. So there has been a great deal of research and development in the design and performance of muffler. From designer's standpoint transmission loss (TL) or insertion loss (IL) is the main characteristic performance parameter of a muffler.

Transmission loss: Transmission loss is the difference in sound power between the

incident wave entering and the transmitted wave exiting the muffler when the muffler termination is anechoic (no reflecting waves present in the muffler) (1). The benefit of TL is that it is a parameter of the muffler alone and the source or termination properties are not needed.

Insertion loss: The Insertion loss is the sound pressure level difference at a point usually outside the system, without and with the muffler present.

2.RESEARCH MOTIVE:

This paper reveals the variation of transmission loss in muffler by using different

absorption materials as the main component for reduction of noise in muffler.

Fig:1 Muffler.

Absorption materials: The use of sound absorption material in an exhaust system dissipates the energy of the acoustic waves into heat and also store heat energy from the exhaust stream. Using an absorptive material can greatly increase the transmission loss of an exhaust system in the mid to high frequency ranges. If the sound absorption materials are measured experimentally then it is done with the two cavity method. As an absorption material is placed inside the muffler the effective expansion area reduces and this sound absorption material absorbs the pressure waves and reflects very little. Some of the absorption materials are fibers, foams, filters.

3. EXPERIMENT DETAIL:

3.1 MATERIAL

3.1.1 Silicon carbide foam:

Silicon carbide foam is low density permeable material with numerous applications. The defining characteristic of these foams is a very high porosity, typically

75 to 95% of the volume consisting of void spaces.

Silicon Carbide

Fig:2 SiC

3.1.2 Characteristics of silicon carbide:

- Low density
- High strength to weight ratio
- High surface area to volume ratio
- Isotropic load response
- Controlled stress-strain characteristics
- It has high porosity and mechanical and chemical stability.
- Excellent resistance to thermal attack and corrosion from molten iron liquid.
- It can effectively remove inclusions; reduce trapped gases from liquid metal.

3.1.3 Specification:

- Porosity: 80~90
- Compression Strength =1.0 MPa
- Bulk Density =0.5g/cm³
- Thermal Resistance =1300°C~R.T. 5 times.

3.1.4 Silicon carbide foam properties:

- Low density ... 3.0 to 3.2 g/cm³
- Tensile strength...210 to 370 Mpa
- Thermal conductivity...120 to 170 w/m k
- young's modulus...370 to 490 Gpa
- Molecular weight...40.1
- Poisson's ratio...0.15 to 0.21

3.2 Fibrous material:

A fibrous object or substance contains a lot of fibers or fiber. Here we can use olefin fiber for covering silicon carbide filter. Olefin fiber is a synthetic fiber made from a polyolefin, such as polypropylene or polyethylene.

Fig:3 olefin fiber

3.2.1 Fibrous material properties (olefin fiber-polypropylene)

- Density...0.855 g/cm³
- Melting point...403 to 444 K
- Hardness and impact strength high
- Young's modulus...1300 to 1800 N/mm²

4.NOISE STANDARD:

Table:1 Noise standard

Vehicle	Highway Operation, soft site,* 35 mph or less	Highway Operation, soft site,* above 35 mph	Highway Operation, hard site,* 35 mph or less	Highway Operation, hard site,* above 35 mph	Stationary Operation, soft site	Stationary Operation, hard site
Motorcycles	78 dB	82 dB	80 dB	84 dB	78 dB	80 dB
Passenger Cars, less than 10,000 pounds	72 dB	79 dB	74 dB	81 dB	72 dB	74 dB
Buses	83 dB	88 dB	86 dB	90 dB	83 dB	85 dB
Vehicles more than 10,000 pounds	86 dB	90 dB	88 dB	92 dB	86 dB	88 dB

Fig:4 Noise std before

Fig:5 Noise std after

5.PRINCIPLE:

5.1 Damping:

Is any effect that tends to reduce the amplitude of vibrations. In mechanics, the internal friction may be one of the causes of such **damping** effect.

5.2Damping ratio:

Is a dimensionless measure describing how oscillations in a system decay after a disturbance. Many systems exhibit oscillatory behavior when they are disturbed from their position of static equilibrium.

$$\zeta = \frac{c}{c_{\text{critical}}}$$

5.3Critical damping:

It provides the quickest approach to zero amplitude for a **damped** oscillator. With less **damping** it reaches the zero position more quickly, but oscillates around it. With more **damping**, the approach to zero is slower.

6.TECHNIQUE OF SOUND REDUCTION:

The sound coming out of the muffler hits the silicon carbide filter due to void spaces present in the filter. the dust deposited into void spaces and also damping creates.due to this damping sound gets reduced.

7.METHOD OF FABRICATION:

- First of all noise and emission test of the muffler can be taken in research center before redesigning.
- Then,We have to cut the available muffler and the silicon carbide foam is coated inside the muffler.
- After, silicon carbide filter can be placed in the inlet side of the muffler.

- The outer side of silicon carbide filter can be covered with fibrous material.(olefin fiber)
- After completing this process the muffler undergoes to welding process
- Finally, noise and emission of the redesigned muffler can be tested in the research center.
- It is found that the noise and emission of the redesigned muffler is gently less when compared with general muffler.

Fig:6 SiC Filter

8.CONCLUSION:

A comfortable environment free from unwanted noises is always dream of every person. One of the sources of unwanted noises is the sound emitted by vehicle. Porous sound-absorbing materials have evolved into more advanced materials over the years. Compared with the older absorbing materials produced in the 1960s, the new materials have become safer, lighter and more technologically optimized. The concept of environmentally friendly, sustainable, recycled, and green building materials will soon have an important role in the marketing of sound-absorbing materials. The production of metal foams, ceramic foams, and aerogels can contribute to greenhouse gas emissions, their practical use in transportation will help in reducing other emissions and help in reducing fuel consumption. Since these materials possess

high structural strength and reduced structural weight simultaneously, their use in the aerospace and automotive industries has the potential to reduce fuel consumption and save energy.

This paper has concentrated on noise attenuation consideration of absorption materials. It was concluded that studying on noise eliminations by innovative material such as silicon carbide foam in experimental and practical approach becomes a new area of study.

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