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Sound and Vibrations: Use of Silica Aerogel-TPO Reinforced Foam Padding System to Improve Sound Dampening in Vehicles

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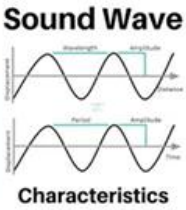
Sound pollution and vibration is a big problem in today's cars. Sound vibrations can affect vehicles by causing a shift in the placement of key components. Sound travels in all forms and can pass through three media- solid, liquid and gas. It does not travel through a vacuum. When driving a car, sound can come from a number of sources-e.g. engine, tires, entertainment system and outside objects that come contact with body of the vehicle. This causes distractions to the driver and also reduces the overall performance of the vehicle. From a technical perspective, this is called noise, vibration, and harshness (NVH) which refers to the car's noise, vibration, and harshness that cause dissatisfaction to the driver. Sound damping in a car is done on the floor, doors, roof, and the vehicle fenders – areas prone to vibration. The purpose of this research is to determine whether aerogel-TPO reinforced foam can effectively suppress sound.

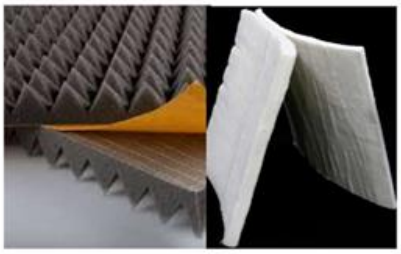
THE PROBLEM

Sound dampening in vehicles is an on-going problem. From rattling doors to clanking parts inside the engine to entertainment systems blaring out of control, we need a better innovation or material to reduce the distractions caused by noise inside and outside of the vehicle.



THE SOLUTION

The solution is to use the silica aerogel foam along with the TPO based foam to create a better sound barrier within the door panel of a vehicle. This includes making sure that the materials are intertwined to get the maximum impact.



RESEARCH PLAN

- Understand how sound is formed and how it travels
- Gather information on sound measurement systems and techniques.
- Develop an approach for testing sound dampening

EXPERIMENTAL SECTION

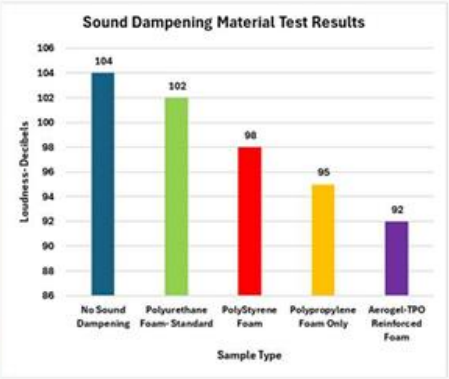
As part of my project, my lab partners provided me with a door panel from a vehicle where the interior panel was removed, exposing the sound dampening foam. I designed a soundproof pouch for a cellphone that contained three material types: sound dampening foam from the vehicle, polystyrene foam, TPO foam and Silica aerogel-TPO reinforced foam. I used sound meter to measure the loudness of the sound of the phone when it is playing a musical selection at maximum volume.

Polyester Foam- Standard

Aerogel-TPO Reinforced Foam

RESULTS

The results of the experiment was very interesting. The data indicates that the aerogel-tpo reinforced soundproof pouch dampened the sound the most.



FUTURE WORK

My future work is to integrate the reinforced aerogel-TPO foam into the side panel of a vehicle and see how it performs under field conditions. I also would like to investigate the potential for this material to be used in trucks and trains.

Conclusion: I did not know what to expect when starting the experiments. I think that it is important for me to continue this work because of the varying number of factors that can affect sound dampening other than material type. I also think that the thickness of the material plays a role as well.

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