

# Researches quiet combustion with patented 'noise sponge'

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(Phys.org) -- A sponge-like material employed by a University of Alabama engineering professor can significantly quiet combustion, possibly making work environments safer and extending the life of equipment.

Dr. Ajay K. Agrawal, the Robert F. Barfield Endowed Chair and professor of mechanical engineering, was recently granted a patent for the breakthrough technology for [noise reduction](#) in [combustion](#).

This technology decreases the [noise](#) generated by combustion systems at the source by placing a sponge-like material directly in the flame. This patent is based on Agrawal's work on jet engine combustion with Ultramet Corp., funded by the U.S. Navy.

The combustion process in several engines, especially those of jets, produces a deafening noise that can also be devastating to the engine. Because the noise level is so high, the sound waves produced can cause intense pulsations. These pulsations shake the engine and result in mechanical failure. The more the engine is exposed to these intense acoustic pulsations, the more likely it is to break down.

So far, noise reduction has been addressed after-the-fact, suppressing the noise outside the engine after the combustion process takes place. Agrawal's technology eliminates the noise at the source, during the combustion process.

The challenge of cutting the sound level during the combustion process is that combustion happens at extremely high temperatures and pressure. Most material cannot withstand such conditions. However, Agrawal found a porous material that can tolerate the conditions of jet engine combustion.

This porous inert material, or foam, is a composite material made of hafnium carbide and silicon carbide. It can withstand intense levels of heat and pressure. The material is placed directly into the flame and acts like a sponge for the noise.

Due to its high permeability, the foam allows gases to easily flow so combustion is not interrupted, yet is much quieter. The foam surrounds the flame, cuts the noise and eliminates the potential for engine instability.

“Experimenting with combustion can be quite noisy and unstable, shaking the whole building, but when you put the foam in place, you can talk to the person next to you. It’s a night and day difference,” Agrawal said.

This technology reduces noise at its source, minimizing the need for bulky and expensive modifications to exhaust equipment. It also increases the uniformity of the combustion and allows for retrofitting of existing systems, which is highly cost efficient. This technology will be useful in gas turbines, burners, furnaces, power generators and other industrial devices using combustion.

The application of the technology extends beyond jet engines. Some chemical manufacturers place loud, high-capacity torches at ground level instead of safer heights to control noise. Factories that rely on combustion also face government regulations to protect employees from noise.

In 1837, The University of Alabama became one of the first five universities in the nation to offer engineering classes. Today, UA's fully accredited College of Engineering has more than 3,300 students and more than 100 faculty. In the last eight years, students in the College have been named USA Today All-USA College Academic Team members, Goldwater, Hollings, Portz and Truman scholars.

Provided by University of Alabama at Birmingham

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