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A Hybrid Metamaterial Sound Barrier

A novel, lightweight, actively controllable metamaterial provides superior sound attenuation and redirects angled sound waves, making it ideal for applications like automobile soundproofing.

Many machines need soundproofing to insulate machine users from noise. Vehicle engine compartments are usually surrounded by soundproofing materials to protect passengers from loud, irritating engine sounds. However, the most widely used sound protection materials are heavy and require the addition of mass to block sound. Existing research on lightweight metamaterial substitutes resulted in materials that only block sound at specific preselected frequencies and are limited to normally incident sound waves.

Researchers at Purdue University have developed a metamaterial with improved sound transmission attenuation compared to conventional materials of equivalent mass per unit area. In addition, it is an improvement on previous metamaterials because it possesses refractive properties that can redirect sound incident at angles other than normally incident. The novel properties of this material are derived from a three-layer construction that includes a front layer of low sound speed material, a core of spatially periodic cells that decompress when subjected to sound waves, and a back end that blocks frequencies higher than the resonance frequency of the core. In addition, the technology is based on active control of various parameters to allow real-time adjustment of the sound barrier.

Advantages:

-Improved sound transmission attenuation compared to materials of equivalent mass per area

-Redirects sounds incident at angles other than normally incident

Potential Applications:

-Automobile manufacturers

TRL: 5

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Category
Automotive & Mobility
Tech/Internal Combustion Engine Optimization
Materials Science & Nanotechnology/Advanced Functional Materials

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