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HKUST Develops New Resonant Sonic Materials to Control Noise

A research team led by Professor Ping Sheng, Head of [Department of Physics](#) at the Hong Kong University of Science and Technology, has successfully produced a new class of resonant sonic materials (RSM). These materials offer great prospects in eliminating noises in daily life, especially low-frequency noises. They can be made into sound shields in highways, soundproof walls in buildings and indoor soundproof partitions, allowing us to get rid of noises from vehicles and other environmental sources.

This important research result by Prof Sheng and his research team has just been released in the latest issue of *Science* magazine (p. 1734, volume 289, published on 8 September 2000). *Science* is acknowledged by international academic circles to be a leading publication on innovative and important scientific research results. When the RSM paper was published, news agencies from countries including Britain (BBC, New Scientist, Reuters Health, PhysicsWeb), the U.S. (Inside R&D), France (Liberation Daily), Brazil (Frohla de S Paulo) and Italy (ScienceNow) have lost no time in conducting overseas telephone and email interviews with Prof Sheng concerning the breakthrough product.

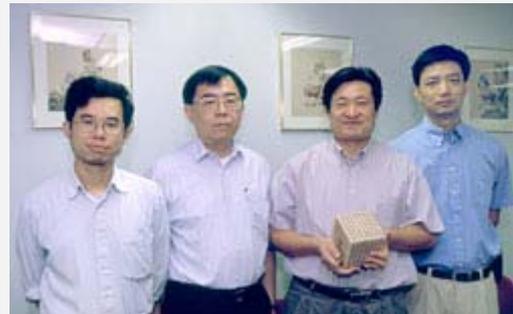
The new RSM are made up of series of small, structured spheres.

Each sphere consists of a solid core of metal with relatively high density and a coating of elastically soft silicone rubber. The whole structure is consolidated by epoxy. The most unusual feature of these materials lies in their negative elasticity constants over certain frequency ranges, thus breaking the limits imposed by the traditional "mass-density law of sound transmission". This allows the materials to totally reflect sound waves within some tunable sonic frequency ranges.

Social and economic development is creating more sources of noise and higher noise levels. Prolonged exposure in a noisy environment may lead to impaired hearing, anxiety, fatigue and other symptoms. It is not difficult to eliminate high-frequency noise based on the properties of sound transmission. But, with traditional materials, it is not easy to completely shield off environmental noise, especially low-frequency noise under 500Hz (because of the mass-density law) where huge soundproof structures are needed. As a result, low-frequency noises from humans, vehicles, pneumatic drills, etc. have continually posed nuisance and threat to our daily life.

The new RSM invented by Prof Sheng et al make control of low-frequency noises realizable. When used in soundproof structures, these materials only take up less than one-tenth of the thickness of traditional materials. Prof Sheng notes that his team has made new progress in their research, so that without increasing their thickness the materials can now totally reflect low-frequency noise of 150 Hz. Prof Sheng further points out that their materials may also be applied to shielding off subsonic vibrations as well as ultrasound, and therefore have potential applications in shock-protection of buildings and "ultrasonic cooling" techniques.

This research project is supported by three grants from the University Grants Committee and the Research Grants Council over a three-year period. Prof Sheng emphasizes that the development of this new class of RSM, from conceptual stage up to the successful materialization of products, has been the persistent effort of the whole research team. The researchers are now working to make the products commercially viable.



[Hi-res image](#) The research team (from left): Dr C. T. Chan, Prof Ping Sheng, Dr Xixiang Zhang (holding the sonic crystal) and Dr Zhiyu Yang.