Exploring the broad applications of airborne acoustic and ultrasonic metamaterials

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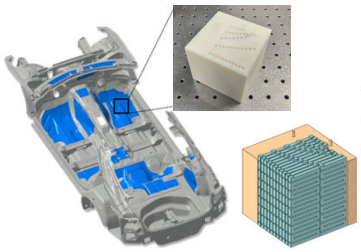
Department of Mechanical Engineering

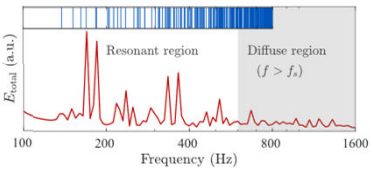
Acoustic absorbers for electric car noise

Contributors: Yonghao Zhen, Shuohan Liu, Sichao Qu (qusichao@hku.hk)

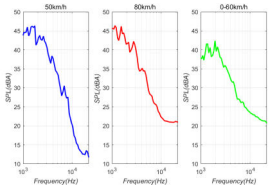


Research idea

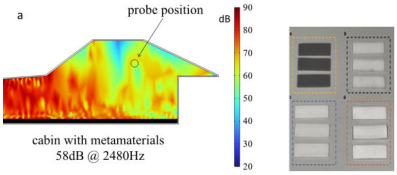
Metamaterial Geometry



Acoustic spectral energy for small space

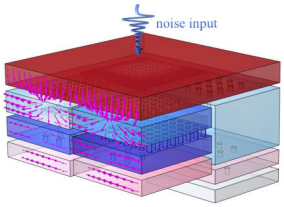


Road noise measurement



Modal analysis

Sample characterization



Multi-resonant acoustic absorber design

Research Highlights

1. **Customizing acoustic metamaterials for EV noise**
2. **Reverberation time control in small space**
3. **Sustainable and Lightweight design**

Head simulator

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APAS 先進能源及智慧交通中心

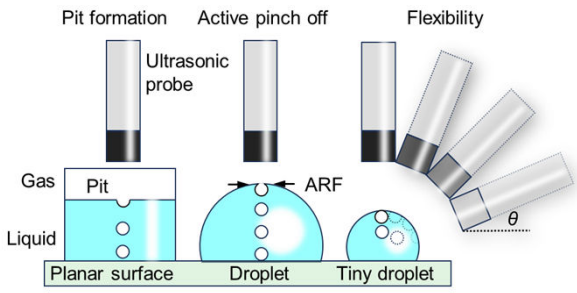
創新科技署 Innovation and Technology Commission

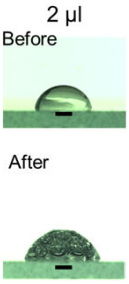
Reference: Building and Environment 244 (2023): 110753.

Acoustic bubbling

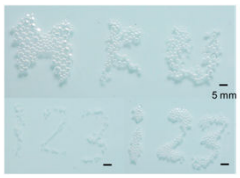
Contributors: Jiaoyuan Lian (jylian@hku.hk)

Scheme and versatility

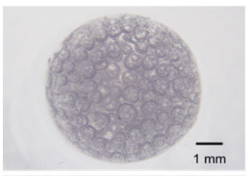


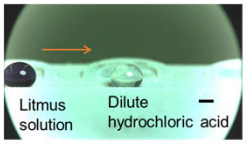


Applications

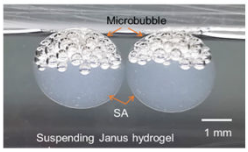


On-demand bubble printing

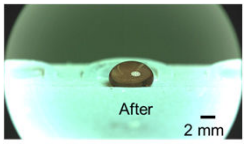




Cured deformation control



Polyporus hydrogel fabrication

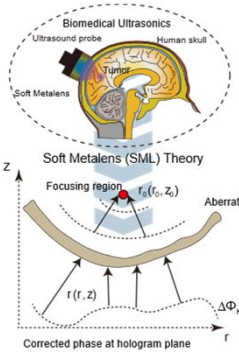


Droplet-scale chemistry

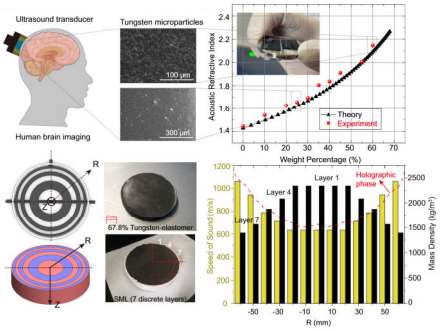
Soft metalens for broadband ultrasonic focusing

Contributor: Erqian Dong (eqdong@hku.hk)

Design principle of soft metalens



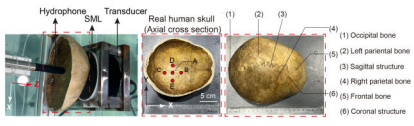
Tungsten particles with soft gels

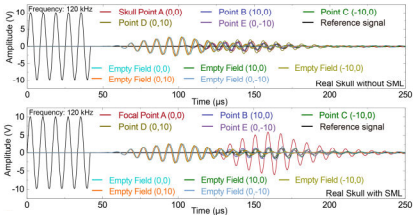


9.3 dB Sound pressure level gain

× 10 times Imaging Resolution

CT image - based transcranial ultrasound





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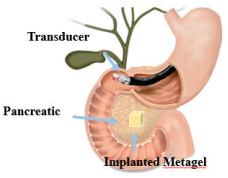
Reference: Nature Communications 16.1 (2025): 308.

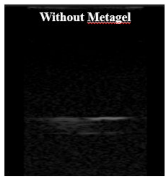
Implantable metagel for Contrast enhanced endoscopic ultrasound

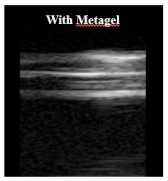
Contributor: Wei Wei Zhang (joshuaweiweizhang@connect.hku.hk)

Biomedical applications of hydrogels have garnered attention as promising implantable devices for Contrast-enhanced Endoscopic ultrasound (CH-EUS).

1. After implanting the Metagel into visceral organs, such as the pancreas, a significant enhancement in contrast can be observed.







2. The reflection of proposed Metagel can be customized with changing the bubble size. (f0=8.1MHz, 7.5MHz and 6.6MHz with d=200μm, 400μm and 600μm, respectively.)