INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Methods and Devices for Generating High-Amplitude and High-Frequency Focused Ultrasound With Light-Asorbing Materials

TECHNOLOGY NUMBER: 5233

OVERVIEW

High-amplitude, high-frequency ultrasound transducer technology for precision applications

- Delivers strong, focused acoustic waves with improved spatial resolution and safety
- Biomedical diagnostics, material analysis, ultrasonic cleaning, and flow-rate sensing

BACKGROUND

Ultrasound technology has been a cornerstone in medical imaging, non-destructive testing, and other fields for decades. Traditional ultrasound transducers predominantly use piezoelectric elements to generate sound waves, but they suffer from limitations in operational frequency—typically under 5 MHz—and produce large focal spots and distances. These limitations hamper their effectiveness in applications requiring high spatial resolutions, such as cellular-level imaging or detailed tissue analysis. Optoacoustic transducers, which utilize laser excitation to generate ultrasound waves, offer higher operational frequencies but fall short in delivering high amplitude pressures, posing risks of thermal damage when pressure enhancements are attempted. Thus, a new method with the capability to produce both high-frequency and high-amplitude ultrasound waves is urgently needed to address these shortcomings and expand the range of potential applications.

INNOVATION

Researchers at the University of Michigan have developed an ultrasound transducer technology called laser-generated focused ultrasound (LGFU). The LGFU technology employs multi-walled carbon nanotube (MW-CNT)-polymer composite films deposited on concave surfaces to produce exceptionally strong optoacoustic pressures—exceeding 100 MPa and 25 MPa on positive and negative peaks, respectively—over a frequency range surpassing 15 MHz. This approach allows for highly focused and powerful ultrasound waves that are both non-invasive and non-ionizing, with a clean bipolar waveform controllable in single pulse units. Potential applications span from high-accuracy therapeutic transducers and biomedical diagnostics to material and structural analysis, ultrasonic cleaning, and more. This innovation overcomes the limitations of conventional methods, setting new standards in ultrasound technology.

ADDITIONAL INFORMATION

Technology ID
5233

Category
Manufacturing Process
Engineering & Physical Sciences
Semiconductors, MEMS, and Electronics

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