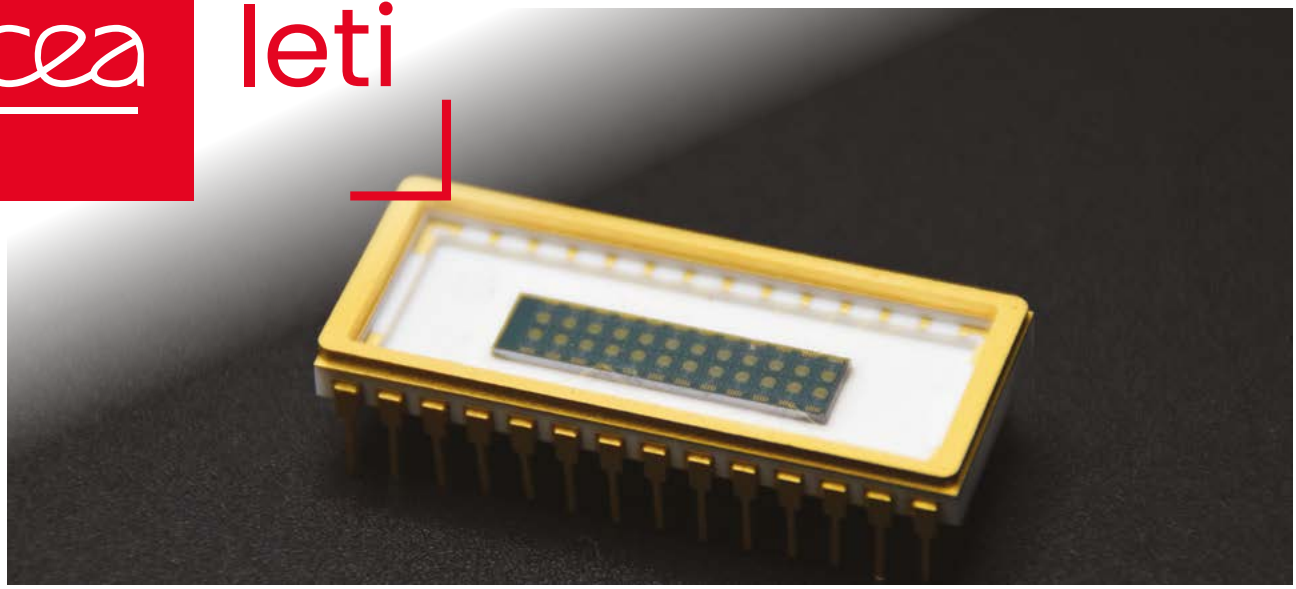
FRANÇAIS ENGLISH

cea leti



PMUT

Low-cost, miniaturized ultrasound emitters/receivers

What is PMUT?

CEA-Leti has designed low-cost, miniaturized Piezoelectric, Micromachined Ultrasound Transducers (PMUTs) capable of operating at different frequencies. PMUT technology coordinates MEMS ultrasound emission and reception components on silicon; these are composed of suspended membranes that can be put into motion by piezoelectric actuators. The actuator structure is made up of thin layers of piezoelectric materials (AlN or PZT) activated by electrodes positioned either side to form a sandwich. Conversely, the electrodes collect charges when the component operates in sensor mode. A beamforming method allows greater component functionality, especially when the emission or reception signal is scanned.

Applications

PMUTs emit ultrasounds up to 3 - 5 m in air. They are also very efficient as emitters/receptors in a liquid medium. PMUT technology is intended for highly varied applications in the medical, consumer or car automotive domain. Its first, already available, commercial applications include fingerprint detection, medical imaging ultrasonography and presence detection, while home automation and virtual reality feature among its targeted future markets.

What's new?

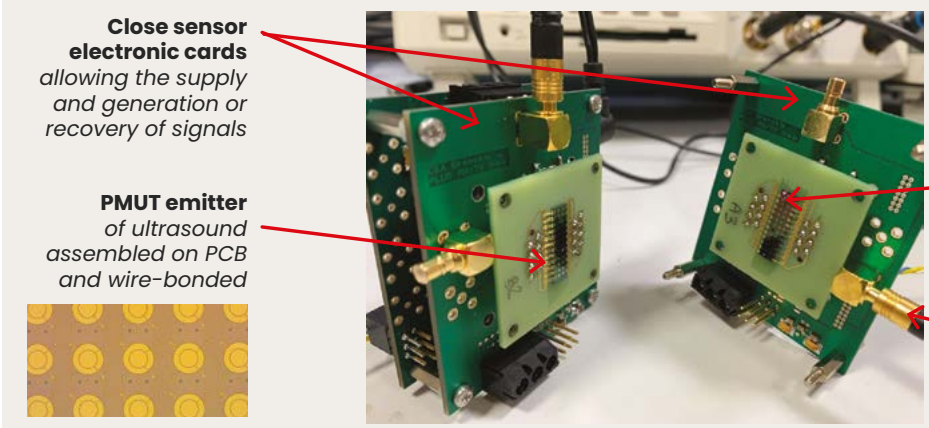
Compared with standard, ceramic piezoelectric transducers, silicon-based MEMS transducers:

- Allow low-cost fabrication of 2D or 3D matrices
- Allow greater miniaturization: 2 to 10 times smaller depending on required performance
- Can achieve a broad range of ultrasound frequencies (1 kHz to 30 MHz depending on size)
- Provide greater bandwidth, while allowing adjustment of the transducer's mid-range frequency
- Provide an overall reduction in transducer based on standard manufacturing processes.

Publications

AlN-based bimorph piezoelectric micromachined ultrasound transducer for air-borne application below 100 kHz
J.Jung, J-C.Bastien, R.Dejaeger, A.Lefevre, O.Ndjoye-Kogou, F.Blard and B.Fain, MUT 2019

Wafer-level experimental study of residual stress in AlN-based bimorph piezoelectric micro-machined ultrasonic transducer
J.Jung, J-C.Bastien, A.Lefevre, K.Benedetto, R.Dejaeger, F.Blard and B.Fain, 2020 Eng. Res. Express 2 045013



What's next?

A more complex electronic system is being finalized; this will enable beamforming to widen the component emission angle for detection of obstructions or objects in invisible areas.

Interested in this technology?

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