Docket #: S08-190

Improved Method for Fabricating 2-D CMUT Arrays

Researchers in the Khuri-Yakub laboratory have developed patented two dimensional (2D) capacitive micromachined ultrasonic transducer (CMUT) arrays and methods for fabricating them with direct wafer bonding. This simple process provides better design flexibility and protection of the CMUT cells throughout most of the fabrication. The CMUT cells are also improved with respect to electrical breakdown voltage and reduced parasitic capacitance. This technique could enable production for almost every CMUT application where 2D arrays are needed, such as medical imaging, high-intensity focused ultrasound (HIFU), and nondestructive evaluation.

Stage of Research
The successful fabrication has been demonstrated at the Stanford Nanofabrication Facility Lab at Stanford.

Related Technology
The inventors have also developed a related technology for making high temperature CMUTs - see Stanford Docket S07-250.

Applications

- **Medical imaging:**
  - 3D/4D real-time ultrasound
  - intracardiac ultrasound
  - 3D photoacoustic functional imaging
- **Therapeutic ultrasound**, such as high-intensity focused ultrasound (HIFU) and MR-guided applications
- **Ultrasonic flow meter (UFM) and nondestructive evaluation (NDE)** applications for which beam steering and focusing is advantageous

Advantages

- **Simple, lower cost fabrication**
  - reduced number of litho-steps for a fully populated 2D array
  - simple fabrication sequence on standard MEMS tools
  - built-in support structure eliminates the need for carrier wafer
  - design flexibility with high controllability for frequency ranges from 1 kHz – 300 MHz
  - increased safety for medical application due to proper ground and shielding concept
- **Improved CMUT cell structure:**
  - increased electrical breakdown voltage
  - reduced parasitic capacitance
  - compatible for monolithic CMOS integration
- **Protection of CMUT cells** - the wafer provides mechanical protection and protection against contaminations during almost all fabrication steps; this improves the yield and reduces the cost per device

Patents

- Published Application: 20090122651
- Issued: 7,846,102 (USA)

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