Docket #: S07-251

Fabrication of CMUTs

Engineers in Prof. Butrus Khuri-Yakub's laboratory have developed a patented, simple, cost efficient, CMUT (capacitive micromachined ultrasonic transducers) fabrication process with incomparable precision and performance. This technique combines local oxidation (LOCOS) with direct wafer bonding to allow vertical tolerances in the 10 nm range with incomparable uniformity over the entire wafer. The process gives design freedom for standard CMUT ultrasound applications (such as medical imaging and therapeutics) and opens the door to new types of technologies (such as bio-chemical sensors).

Stage of Research
The inventors have successfully fabricated CMUTs with gap heights of only 40 nm, with a significantly larger thermal oxide post thickness (~1 μm) with excellent uniformity (2 nm) over the whole wafer and with excellent yield and reproducibility. This process enabled the fabrication of a CMUT suitable for bio-chemical gas sensor applications.

Applications

- **Chemical and biological sensors**
- Medical imaging
- Therapeutic ultrasound - High intensity focused ultrasound (HIFU)

Advantages

- **Precise control** of all longitudinal dimensions, including insulation layer thickness and gap height
- **Scalable** - the process uses all batch fabrication steps (wet etching, oxidation and deposition), which are applicable to mass production and low cost fabrication

- **Independent control** of gap height and insulation layer thickness (CMUT membrane post)
- **Low parasitic capacitance and high breakdown voltage** of CMUTs fabricated with this process
- **Smooth surface roughness** without requiring any chemical-mechanical polishing step

Publications

- K. K. Park, H. J. Lee, M. Kupnik, Ö. Oralkan, and B. T. Khuri-Yakub, "Fabricating capacitive micromachined ultrasonic transducers with direct wafer-bonding and LOCOS technology," Proc. 21th IEEE MEMS Conference, Tucson, USA, pp. 339-342, 2008.

Patents

- Published Application: 20090142872
- Issued: 7,745,248 (USA)

Innovators

- Kwan Park
- Butrus Khuri-Yakub
- Mario Kupnik

Licensing Contact

David Mallin

Licensing Manager, Physical Sciences

Email