One of the earliest pMUT designs for underwater sonar was reported (Bernstein et al. 1997) utilizes PZT as piezoelectric material and fluid medium to provide acoustic coupling. The transducer frontal area was sealed with epoxy for water proofing while the silicon rubber was used to waterproof the electronics.

There was an effort to improve acoustic impedance mismatch between piezoelectric material and fluid medium. It has been demonstrated that the use of parylene matching layers can reduce the mismatch at high frequencies (Dorey et al. 2007). The use of parylene layers at 9.5 µm thickness resulted in better performance at 50 MHz, undergone underwater calibration with the present of 9.5 µm of parylene matching layer (Dorey et al. 2007).

As for airborne applications, a 7.5 kHz and 13.3 kHz resonances microphone and micro-speaker was reported (Ko et al. 2001). The device used a stack of layers, including 7 µm SiO2 layer, 0.1 µm bottom electrode Ti-Pt layer, 1 µm PZT piezoelectric layer and 0.08 µm top electrode Pt layer.

A pMUT having resonance frequencies at 0.45, 1.5 and 4.2 MHz with air load have also been reported later (Percin and Cross 1999). The device used a 3 µm ZrO2 layer functions as DBL layer on top of SiO2 at 50 nm, whom act as a stopping layer during dry etching process.

An eight-layers [Si/SiO2/Si/SiO2/Ti/Pt/PZT/Au] pMUT array using 0.8 µm PZT was fabricated for airborne acoustic transmission applications (Muralt et al. 2005). The device carries 750 kHz of resonance for 30 mm airborne acoustic transmission.

A square pMUT with 7 µm thick PZT on Pt-Ti/LTO/SiN/SiO2/Si was reported having 41 kHz, 118 kHz and 146 kHz of resonances for airborne acoustic applications (Xiaoming et al. 2006). The pMUT with active damping feature was reported having resonance at approximately 55 kHz with narrow bandwidth due to active damping feature (Xiaoming et al. 2006).

References:


