Novel Thick Film Transducers for High Frequency Ultrasonography

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Key words: Transducers, thick film, high frequency ultrasound, pulse compression, Golay code

ABSTRACT

New types of thick-film transducers (19 to 37 MHz), with integrated highly attenuating ceramic backing formed of porous PZT material and shaped to the required ROC, were developed. For this project, focused transducers (focal depth 13 mm) with two different compositions, Ferroperm Pz24 and Pz26 with different dielectric constant were fabricated. The transducers were carefully measured, then electrically and acoustically matched to the acoustical impedance of tissue and next mounted in a mechanical wobbling imaging probe. The transducers were excited with Golay coded sequences at 35 MHz.

Introducing the coded excitation allowed replacing the short-burst transmission at 20 MHz with the same peak amplitude pressure, but with almost double center frequency, resulting in considerably better axial resolution. The important factor for coded transmission/reception is the matching of the transducer bandwidth with the one of the coded signal. The thick films exhibited at least 30% bandwidth broadening comparing to the standard Pz27 transducer, resulting in an increase in matching filtering output by a factor of 1.4-1.5 and finally resulting in a SNR gain of the same order. Examples of skin scans obtained with the new thick-film transducers are presented. Further improvement of the transducer performance is demonstrated through optimizing the electrical impedance of the HF transducer. This is obtained by using a thick-film component prepared from a lower dielectric constant material, whilst the electromechanical coupling is maintained at approx. 50%.