

Thick Film Transducers for High Frequency coded Ultrasonography

A. Nowicki¹, J. Wojcik¹, M. Lewandowski¹, R. Tymkiewicz¹, R. Lou-Moller², W. Wolny² and
T. Zawada³

¹ *Institute of Fundamental Technological Research, Ultrasonic Department, Warsaw, Poland*

² *InSensor A/S, Hejreskovvej 18A, 3490 Kvistgaard, Denmark*

³ *Ferroperm Piezoceramics A/S, Hejreskovvej 18A, 3490 Kvistgaard, Denmark*

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ABSTRACT

Recently a new technology of piezoelectric transducers based on PZT thick film has been developed as a response to a call for devices working at higher frequencies suitable for production in large numbers at low cost. Eight PZT thick film based focused transducers with resonant frequency close to 40 MHz were fabricated and experimentally investigated. The PZT thick films were deposited on acoustically engineered ceramic substrates by pad printing. Considering high frequency and nonlinear propagation it has been decided to evaluate the axial pressure field emitted (and reflected by thick metal plate) by each of concave transducer differing in radius of curvature - 11 mm, 12 mm, 15 mm, 16 mm.

All transducers were activated using AVTEC AVG-3A-PS transmitter and Ritec diplexer connected directly to Agilent 54641D oscilloscope. As anticipated, in all cases the focal distance was up to 10% closer to the transducer face than the one related to the curvature radius. Axial pressure distributions were also compared to the calculated ones (with the experimentally determined boundary conditions) using the angular spectrum method including nonlinear propagation in water.

The computed results are in a very good agreement with the experimental ones. The transducers were excited with Golay coded sequences at 35-40 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 thick films exhibited at least 30% bandwidth broadening comparing to the standard PZ 27 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.