

Comparison between 1-3 piezocomposite and PZT ceramic for high-intensity  
focused ultrasound transducer application

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Abstract

In this study, one PZT-ceramic focused transducer and 1-3 PZT4-epoxy composite focused transducers with various volume fraction and aspect ratio were constructed in-house for the evaluation of coupling factor, dielectric tangent loss, mechanical quality factor, bandwidth, electro-acoustic efficiency and acoustic impedance. The experimental results demonstrated that the coupling factor of composite transducers varied from 0.61 to 0.68 when that of the ceramic transducer was 0.49. Loss tangents at 1 kHz of composite transducers and that of the PZT-ceramic transducer were in the same scale. The mechanical quality factor of composite transducers was lower than that of the PZT-ceramic transducer due to more thermal loss induced in epoxy. As a result, the ceramic transducer had higher efficiency (87% approximately) as compared to the composite transducers (57%~67%). For all that the bandwidth of composite transducers was wider than that of ceramic transducer and the characteristic acoustic impedance of composite transducers was apparently lower than that of ceramic transducer. Therefore, the optimized 1-3 piezocomposites possess advantages of flexible shaping, wide bandwidth, low acoustic impedance and reasonable efficiency and are suitable for HIFU transducer applications.

Keyword : Impedance Analyzer; Pulse-echo measurement; Radiation force balance; Sound velocity measurement.