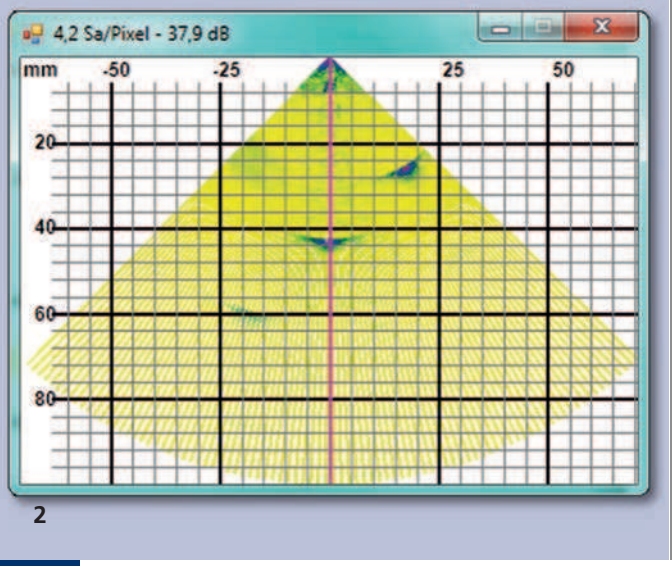
1



2

NEW HIGHLY SENSITIVE PHASED ARRAY PROBES BASED ON PMN-PT COMPOSITES

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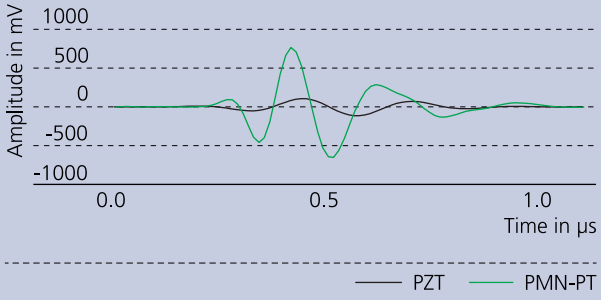
The single crystals of lead magnesium niobate/lead titanate (PMN-PT) are well known for their excellent piezoelectric properties and therefore make PMN-PT a promising material for the development of highly sensitive ultrasound transducers. Furthermore, they can be processed using the dice and fill composite technique as is used for PZT ceramics.

Piezoelectric 1-3 composites based on PMN-PT single crystals were developed, characterized, and used for the manufacturing of phased array probes in cooperation with the Korean company IBULE photonics. The goal of this project was to show that the new highly sensitive composite materials can be used for the manufacturing of ultrasound transducers and the conventional PZT-based composites can be replaced without extensive adjustment of the technological process. Phased array probes were manufactured from both composite materials with the same parameters, and then compared. For this purpose, ultrasound tests were performed on a simple polystyrene test body (Rexolite®) with a flat back wall at a distance of 18 mm as well as on a titanium test body with three diagonally situated side drill holes of diameter 0.5 mm.

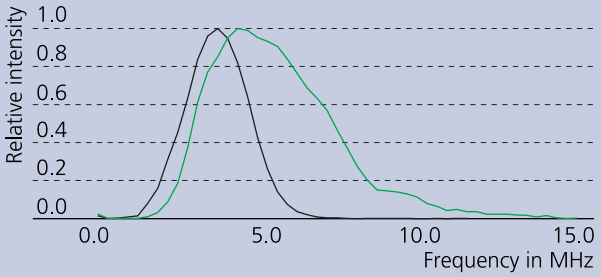
The results showed a sensitivity level that was more than 10 dB higher and a bandwidth that was 20 % higher for the PMN-PT-based transducer than for the conventional PZT-based one.

The new PMN-PT-based transducers are particularly interesting for applications where low signal-to-noise ratios can be expected due to geometric attenuation or long travel paths in the material under test.

Echo signals from a back wall at a distance of 18 mm



Frequency spectra of the above signals



1 *PMN-PT-based phased array probe on titanium test body with diagonally situated side drill holes.*

2 *Phased array sector scan between -45° and +45° with clear indication of drill holes.*

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