

Lead-free ultrasonic transducers, technology and comparison between performance of traditional and thick film high frequency PZT and KNN based transducers

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ABSTRACT

Lead zirconate titanate (PZT) and lead meta-niobate (PMN) materials widely used at present, have excellent piezoelectric properties and well established technology, however, their lead content, with its high toxicity and waste deposition problems politically limits their future in many fields such as health care, consumer electronics, ICT among others.

Among many possible candidates for replacement of PZT materials, KNN family materials (modified potassium sodium niobate) have been selected for attractive piezoelectric properties. Similarly to PZT material, it also offers possibility of tailoring the material properties for different applications and requirements.

In this paper we present results for a selected modified KNN composition we have developed with the focus for structure health monitoring (SHM), incl. aeronautics and medical applications such as implants.

The paper presents the industrial scale manufacturing process for KNN materials, both in bulk and thick film Insensor® technology, the latter offering in addition possibility of including some of the transducer assembling steps into the manufacturing process of the films. The performance of 2 MHz and 4 MHz transducers prepared of bulk PZT and KNN along with 20 MHz or higher frequency Insensor® PZT and KNN thick films will also be presented and evaluated.