Some initial results with acoustic superlattice transducers made by domain inversion of $LiNbO_3$

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Abstract

Conventional acoustic transducers for acousto-optic devices are typically made by bonding a plate of piezoelectric material such as $LiNbO_3$ to the crystal or glass in which the acousto-optic interaction is to take place. The plate is then thin lapped and polished down to the required thickness, typically of the order of half an acoustic wavelength. While these transducers work well with many applications, it is possible to make acoustic transducers by a very different method, using electrically induced domain inversion in ferroelectrics. In these "acoustic superlattice transducers", the resonant frequency is no longer controlled by the overall physical dimensions of the transducer but by the period of the domain inverted regions. These are in turn defined by a photolithographic technique. Such transducers can be configured in many different ways to produce e.g. shear, longitudinal and Rayleigh waves, and in addition open the possibility to a "bondless" acousto-optic device in which the transducer and acousto-optic interaction medium are one and the same. One result of this is that the bandwidth of the resulting devices is potentially greater. We present some preliminary results demonstrating transducers fabricated in this material, and discuss some of the theory of operation.

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