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High Overtone Bulk Acoustic Resonators Based on Thinned
Single-crystal Piezoelectric Layers : Filters and Frequency Sources
Applications

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The thin film bulk acoustic wave resonators exploiting the thickness-extensional vibration mode of piezoelectric thin films is a key technology as alternative solutions to standard SAW resonators. Lakin have emphasized the capability of High Overtone Bulk Acoustic Resonators to present high quality factors at frequencies in the GHz range. HBAR spring from the conjugation of the strong coupling coefficient of deposited piezoelectric thin films and of the high intrinsic quality of used substrates. The piezoelectric film and the two electrodes on its both sides are used as transducer whereas the acoustic energy is mainly trapped in the substrate. The resonant frequency corresponds to a half wavelength in the entire thickness of the device and, in opposition to FBAR, we can utilized both odd and even harmonics. The fundamental, generally in the vicinity of 10~MHz, has no specific interest but $Q \cdot f$ products around 1.1×10^{14} have already been obtained for high overtones using aluminum nitride thin films deposited onto sapphire. In view of improving the Q factor of thin films, it is desirable to use a single-crystal piezoelectric material such as lithium niobate. We show and compare the fabrication in both approaches. Different measurement results are exposed for both approaches for the fabrication of oscillator and filters are shown and discussed.