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Measurement of fast dynamic strain generated by focusing of surface acoustic waves[1] UDAY SINGH, Univ of Nebraska - Lincoln, Y. LI, D.A. WALKO, Argonne National Lab, S. ADENWALLA, Univ of Nebraska - Lincoln
— We have measured the spatial and temporal dependence of high frequency (88 MHz) strain waves in a focused surface acoustic wave (FSAW). Increasing the strain generated by a SAW to levels that are comparable with epitaxial strains in thin films ($\sim$ 1%) necessitate annular inter-digital transducers (AIDT) that follow the constant velocity curve of the piezoelectric surface to focus the strain wave over a small focal area. A detailed analysis of the strain around the focal center of an AIDT patterned on 128 Y-cut $LiNbO_3$ shows shifts in the (104) x-ray diffraction peak. The AIDT spacing was chosen to produce a resonance at the ring frequency of the Advanced Photon Source, where x -ray diffraction measurements were carried out with a focus of 7 μm. The spatial dependence of the strain is identical to that measured using light reflectivity. From x-ray diffraction measurements, we obtained a quantitative measure of the strain amplitude, 0.5% at an AIDT excitation power of 24 dBm. The temporal dependence showed a sinusoidally varying strain that cycles between compressive and tensile at the frequency of the AIDT excitation. Diffraction measurements of a Pt thin film grown on the $LiNbO_3$ show significant strain transfer. These data lay the groundwork for future experiments that involve tuning the physical properties of strain sensitive thin film materials at high frequencies.

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