# A High Velocity and Wideband SAW on a Thin $LiNbO_3$ Plate Bonded on a Si Substrate in the SHF Range

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Background, Motivation, and Objective

Over the past few years, much attention have been paid to an extremely low-loss and low-TCF (Temperature coefficients of frequency) SAW (Surface acoustic wave) devices comprising a thin piezoelectric single crystal plate whose thickness is less than a wavelength of an acoustic wave propagating in the plate bonded on a handle substrate.

I.H.P. SAW (Incredible high performance SAW) products have been commercialized as filters of Band 25, Wi-Fi, and so on. However, much higher frequency with wider bandwidth applications for future mobile communication systems may be tough because its SAW mode is basically the same as a conventional leaky SAW propagating on a rotated Y-cut $LiTaO_3$ substrate that features moderate electromechanical coupling factor of 7-10 % and phase velocity of approximately 3,800 m/s.

In order to realize high-velocity, low-loss, large coupling factor and low-TCF simultaneously, the authors introduced the I.H.P. SAW technologies into an LLSAW (Longitudinal leaky SAW). We have proposed a structure comprising an X-cut $LiNbO_3$ thin plate, acoustic mirror and handle substrate for overcoming weaknesses of the LLSAW.

Statement of Contribution/Methods

This talk discusses how effective the proposed structure is in the SHF range.

Results/Discussion

First, it is shown how the current structure is effective to confine an acoustic energy in the vicinity of top surface.

Next, it is shown how high performances are achievable by applying the proposed structure, and also demonstrated that 3.5 GHz to 5 GHz range SAW devices can be fabricated by using a KrF stepper/scanner common in current mass production.

Finally, achievable performances are compared from various aspects with SAW devices employing the other technologies.