

SAW resonator on YX36 LiNbO₃/SiC bilayer structure

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Abstract- In the last few decades the wireless communications networks have seen an aggressive development leading to a new generation of network every 10 years. Nowadays with 5G, high data rate and broad frequency range are needed due to the growing number of connections and data usage. This has led to additional challenges for RF acoustic resonators which have now even more stringent requirement for what concerns resonance frequency and electromechanical coupling. In this context the state of art is represented by piezoelectric MEMS based on AlScN, LiTaO₃ and LiNbO₃.

In this work a SAW-like resonator on a YX36 LiNbO₃ /SiC bilayer attached together through an extremely thin polysilicon layer (40nm) is presented. This kind of device, already proposed in different configurations¹⁻³ combine the SAW devices relatively simple fabrication process and frequency tuning with the acoustic insulation provided by the presence of SiC which prevents energy losses into the substrate. This work has included 2D simulations for the optimization of SH0 mode above 3 GHz for YX36 cut, 3D simulation for transverse spurious mode suppression, fabrication, and characterization through Vector network analyzer. As a result, the measured devices present resonance frequency between 3-4 GHz, resonances relative ratio (RaR) and quality factor respectively up to 6.7% and 209.

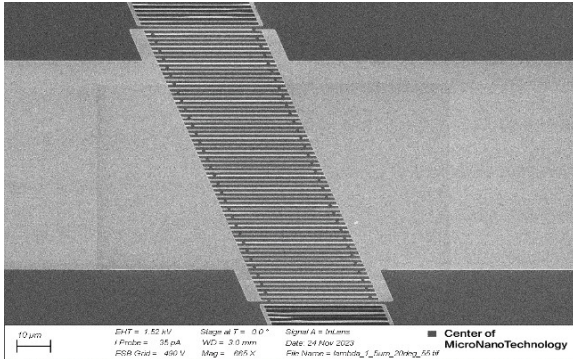


Fig. 1 : SEM image of the active region of a device with 20° of busbar tilting for transverse spurious mode suppression.

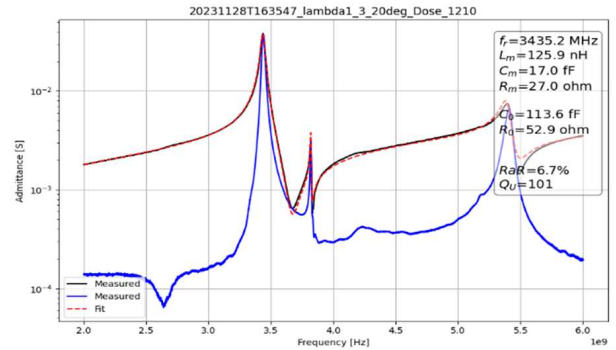


Fig. 2: Measurement of a device with $f_{res}=3.4$ GHz and $RaR=6.7\%$.

1. H. Xu et al., “SAW Filters on LiNbO₃ /SiC Heterostructure for 5G n77 and n78 Band Applications,” IEEE Trans. Ultrason. Ferroelectr. Freq. Control, vol. 70, no. 9, pp. 1157–1169, Sep. 2023, doi: 10.1109/TUFFC.2023.3299635.
2. S. Zhang et al., “Surface Acoustic Wave Resonators Using Lithium Niobate on Silicon Carbide Platform,” in 2020 IEEE/MTT-S International Microwave Symposium (IMS), Los Angeles, CA, USA: IEEE, Aug. 2020, pp. 253–256. doi: 10.1109/IMS30576.2020.9224017.
3. L. Zhang et al., “Spurious-Free and Low-Loss Surface Acoustic Wave Filter Beyond 5 GHz.”