$LiNbO_3$と低熱膨張率ガラスを用いた温度安定性に優れた広帯域表面弾性波共振子

Wideband Surface Acoustic Wave Resonator with Good Temperature Stability Using $LiNbO_3$ and Glass with Low Coefficient of Thermal Expansion

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派遣先　国際超音波シンポジウム（カナダ・モントリオール）
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海外における研究活動状況

研究目的

The International Ultrasonics Symposium is a prestigious event that fosters collaboration, encourages innovation, and facilitates the sharing of knowledge among experts and enthusiasts in the field of ultrasonics. In the symposium, I gave an oral presentation about the research that aims to improve the temperature stability of wideband surface acoustic wave (SAW) resonator. Wideband usually means larger temperature coefficient of frequency (TCF) due to larger sensitivity to temperature change. Consequently, large bandwidth and low TCF are very difficult to be realized simultaneously. In this work, we combined $LiNbO_3$ and a glass with low coefficient of thermal expansion to obtain large BW and low TCF simultaneously. Through the participation, I hope to gain valuable insights, make connections, and find inspiration for my research pursuits.

海外における研究活動報告

Participating in the International Ultrasonics Symposium (IUS) was a remarkable experience. Held at Montreal, Canada from 3rd to 8th, Sep., this prestigious symposium convened experts and researchers from diverse backgrounds to delve into the intricacies of the ultrasonics field.

At the heart of my IUS experience was the opportunity to present my own research during a dedicated session. My work entitled 'Wideband Surface Acoustic Wave Resonator with Good Temperature Stability Using $LiNbO_3$ and Glass with Low Coefficient of Thermal Expansion' was selected as a lecture presentation, which aims to improve the temperature stability of wideband surface acoustic wave (SAW) resonator. Large bandwidth (BW) and low temperature coefficient of frequency (TCF) are very difficult to be realized simultaneously. In this work, I combined $LiNbO_3$ and a glass with low coefficient of thermal expansion and successfully obtained large BW and low TCF simultaneously. Numerous researchers and experts listened my presentation and give valuable comments to me. This experience was invaluable, as it provided me with a platform to share my work with fellow researchers, experts, and peers. The feedback and discussions that followed were constructive and enlightening,

offering fresh perspectives and opening doors to my future researches.

The symposium also offered a plethora of sessions that covered a wide range of topics within acoustic wave device field. I had the opportunity to explore cutting-edge research that is pushing the boundaries of our understanding in this field. For example, a researcher from Qorvo, Inc. shared the advanced simulation techniques using coupling of mode (COM) theory to study and predict transverse mode in SAW device. And the apodization shape was optimized to obtain spurious free characteristics at the same time maintaining high quality (Q) factor. Another fantastic research was about the 'all-metal Bragg reflector', which was proposed to excite higher order thickness extension mode, at the same time the fundamental mode is suppressed. Additionally, the ohmic loss was reduced due to the all-metal design, and there is no need for package. High Q more than 90 and effective coupling factor more than 2.2% were realized using AlN at 55.7 GHz. Apart from that, periodic poled piezoelectric film (P3F) was adopted by lots of groups, such as Akoustis, Inc. and UT Austin. The P3F was effective to increase the film thickness while maintaining good frequency characteristics at high frequency range. These novel methodologies, techniques and ideas enhanced the quality and depth of my own researches.

Moreover, IUS provided ample networking opportunities. Informal interactions during coffee breaks, poster sessions, and social gatherings were just as valuable as the formal sessions. These connections have the potential to lead to future collaborations and partnerships, expanding the reach and impact of my research.

Sincere thanks to Murata Science Foundation for the financial support of attending IUS. My participation in the IUS was an enriching and transformative experience. It provided me with the opportunity to share my research, gain valuable insights, and establish connections with researchers from around the world. I will continue to conduct in-depth scientific research and endeavor to contribute to the field of acoustic wave devices.

この派遣の研究成果等を発表した
著書、論文、報告書の書名・講演題目

Lecture presentation in IUS:

Yong Guo, Michio Kadota, Yuji Ohashi and Shuji Tanaka, Wideband Surface Acoustic Wave Resonator with Good Temperature Stability Using $LiNbO_3$ and Glass with Low Coefficient of Thermal Expansion, 2023 IEEE International Ultrasonics Symposium (IUS), Sep. 3-8, 2023. Montreal, Canada.