



JASDAQ

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To whom it may concern,

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Notice on Success of Production of Sales of Gas Cells of New Miniature Atomic Clocks -Emergence into the New Market from Ultra-high Precision Magnetic Sensor to Gyroscope Sensor-

We are pleased to inform that we have succeeded in verification of the method to produce small-size gas cells which greatly control performance of miniature atomic clocks at a low cost (patent pending) in the research and development which we had conducted jointly with Tohoku University. We have also succeeded in demonstration of the principle of miniature atomic clocks which was conducted as such demonstration experiment. Please be noted that we will hereafter proceed with hearing of the specifications, etc. in consideration of individual sales of gas cells and further research and development.

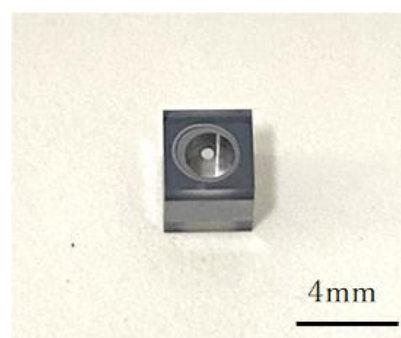


Fig. 1: Gas cell successfully developed

1. Background

As we announced in “Commencement of Research on Application Using a Miniature Atomic Clock and Atomic Clock” dated July 6, 2020, we have conducted the joint research of application using the miniature atomic clock and atomic clock with Professor Takahito Ono of School of Engineering, Tohoku University as the research representative.

2. About miniature atomic clocks and gas cells

Miniature atomic clocks are currently used for satellites, planetary exploration spacecrafts, communication base stations, etc., and expected to be mounted on mobile terminals such as smartphones, etc. and power control systems, etc. such as smart grid in the future. For example, when used for time synchronization, it can be synchronized with UTC (Universal Time Coordinated) from GPS (Global Positioning System) signals to minimize delay of signal transmission time between multiple bases and between terminals, which enables to reduce delay of video and sound of web meetings, etc. that have been broadly used recently.

This miniature atomic clock has a small container with glass window thereon, where alkaline atom called gas cell is encapsulated. With incident laser light into this gas cell, quantum interference phenomenon called CPT (Coherent Population Trapping) resonance is caused to extract the signal equivalent to the difference of energy levels of alkaline atoms and output the stabilized clock signals. The gas cell greatly determines performance of the miniature atomic clock and has been in process of many developments at laboratories, etc. worldwide, but there is an issue in the production method where cost problems remained. Then although relatively easy production method using solid materials was applied, there was an issue to be solved in the size and performance.

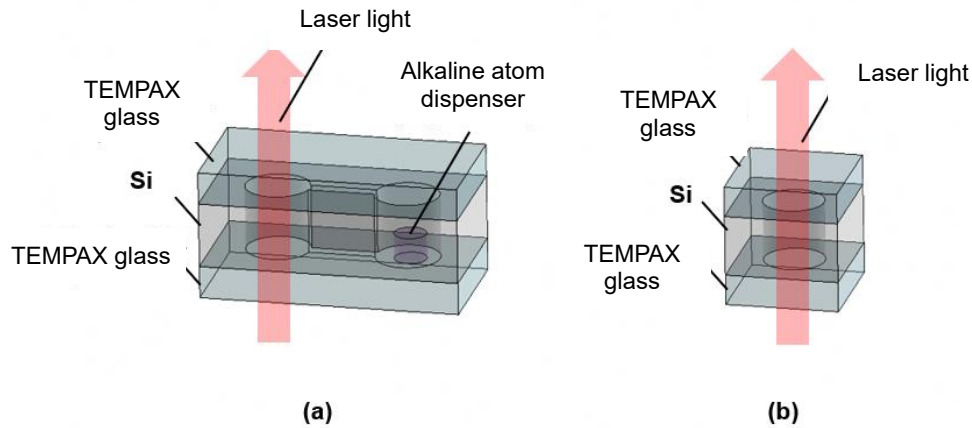


Fig. 2: Gas cell using alkaline atom dispenser (solid material including alkaline atom) (a) The conventional-type gas cell with dispenser remaining (b) Gas cell verified in this experiment. The dispenser was separated to achieve downsizing, high performance, and cost reduction.

3. Development of concern

We invented the new gas cell production method to solve the above problem, applied for patent, proceeded with production and evaluation and succeeded in such verification (See Fig. 1). This production method uses the technology called MEMS (Micro Electro Mechanical Systems) applying the semiconductor microfabrication technology, achieving downsizing to a half of the gas cell produced by the conventional method (See Fig. 2).

The details will be announced at the 38th “Sensor Micromachine and Applied System” symposium to be held online through November 9, 2021 (Tue) to November 11, 2021 (Thu).

4. Future approach

The gas cells with alkaline atom encapsulated in are used for light quantum sensors such as high precision magnetic sensor and gyroscope sensor, etc. besides miniature atomic clocks and the market is expanding. We will accelerate development of miniature atomic clocks using new gas cell as well as entering the market by conducting hearing the specifications, etc. in consideration of individual sales of gas cells hereafter to promote establishment and application of the basic technologies.

As we announced in the “Notice on Commencement of Joint Research with Tohoku University (Sendai City, Miyagi Pref.)” dated February 14, 2019, we are proceeding with the joint research with Yasubumi Furuya, Academic Researcher at Tohoku University, Micro System Integration Center (former Specially-appointed Professor at Tohoku University, Emeritus Professor at Hirosaki University) as the research representative for the research and development of the optimization device control / monitoring system of surplus power which is expected to be utilized in the natural energy (solar power, wind power, biomass, hot spring heat, etc.).

While needs of the time and society drastically change, we aim for business expansion by finding issues and additional needs and expanding from the existing technological area to a new area. With communication (5G), environment, disaster measures as the keywords and by providing solutions in the “communication” and “energy” fields which will become the infrastructure of smart cities, we will contribute realization of “decarbonated society.”