

Formation of Center of Excellence of UMS Technology

Ultrasonic Micro-Spectroscopy (UMS) Technology

Quantitative Measurement & Imaging

⇒ Analysis and evaluation of material characteristics (velocity & attenuation)



Quality improvement in electronic materials and device fabrication processes by UMS tech.

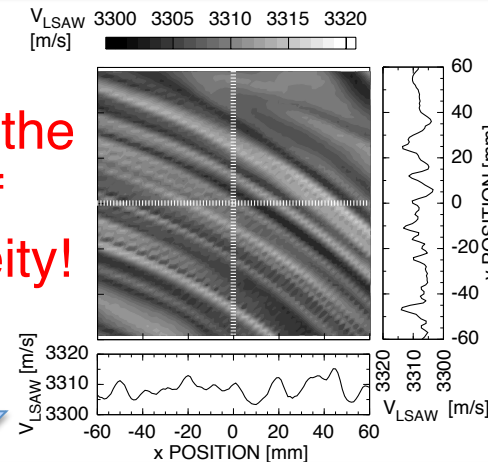
- Functional glasses
- Wide-gap semiconductors
- Piezoelectric materials
- Ferroelectric materials
- Bio-tissues

Tohoku Univ.
UMS Research Center

- Establishing dictionary
- Collaborative research
- Sharing of systems
- Training of operators

Commercial $\text{TiO}_2\text{-SiO}_2$ ultra-low expansion glass

Resolving the problem of homogeneity!

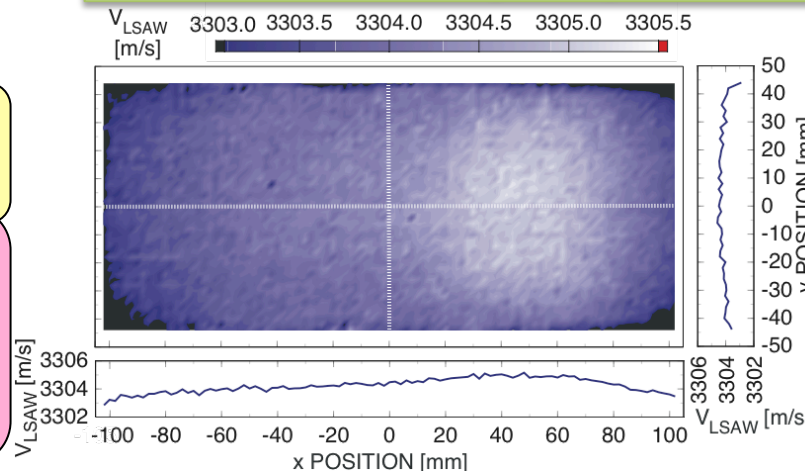


Av.: 3308.10 [m/s]

Diff: 12.98 [m/s]

$\Delta\text{CTE} = 56 \text{ ppb/K}$

Homogenized $\text{TiO}_2\text{-SiO}_2$ ultra-low expansion glass



Within $\pm 5 \text{ ppb/K}$

Av.: 3304.05 m/s

Diff: 3.82 m/s

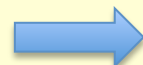
$\Delta\text{CTE} = 16.8 \text{ ppb/K}$

**J. Kushibiki et al.,
Appl. Phys. Express,
Vol. 1, 087022
(2008).

Evaluation Method of Next Generation Functional Glasses

Functional Glasses

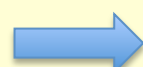
▪ Ultra-low expansion glass



Applications

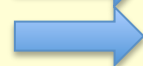
Extreme Ultra-Violet Lithography (EUVL)
Optical frequency standard, Opt. communication,
Instrument under ultimate environment,
Super accurate optical measurement

▪ Synthetic silica glass



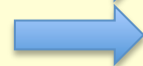
Optical lithography, Super accurate opt. meas.

▪ Hardened glass



High-rise building, Super-thin display

▪ Crystallized glass



Optical-fiber device

Contributions to Realization of Next Generation Electronic Devices

Contribution to Information Communication

JST Development of Systems and Technology for Advanced Measurement and Analysis,
“Development of ultra-high quality optical cavity for optical frequency standard,” FY: 2008–2010).

- ① CTE distribution in cavity material $< \pm 5$ ppb/K
- ② Zero CTE temp. of cavity material: $20 \sim 25^\circ\text{C}$
- ③ Finesse of resonator $> 1,000,000$

Creep of cavity length is extremely smaller than that of commercial cavity.



Development of Reference Cavity in Frequency Band for Optical Communications