Formation of Optical Coupling Structure between Silica Glass Waveguides and Molten Tellurite Glass Droplet S. Todoroki (轟 眞市), A. Nukui & S. Inoue Advanced Material Laboratory Mass Japan  $l \sim 0.6 \,\mathrm{mm} \longrightarrow v \sim 0.007 \,\mathrm{mm}^3 = 7 \,\mathrm{n}\ell$ 



Optical Coupling Structure btw Silica Fibers & Tellurite Glass.

**Fabrication method** 

How did we make it? What is the advantage?

**Optical performance** 

How much is the loss? Is it adequate?

**Possible application** 

What can it be used for?

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### Fabrication method Temperature control is critical



# Optical performance Measuring internal reflection







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& tank



- in Loss (11): Disalignment 💳
- in Distance ( $\Leftrightarrow$ ): Solidification during pulling

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Fabrication method

Not yet checked by XRD, but...

- ✓ No light reflection from inside
- $\checkmark$  Insertion loss: same as  $80 \text{TeO}_2 20 \text{ZnO}$
- Can survive the bending test





 $\implies$  No harmful precipitates for optical applications

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### Heat history









### No waveguide, No use.

**Demerit:** Lack of waveguide structure

#### To be improved:





## for reducing insertion loss

- Make a waveguide structure afterwards
  - by fs-laser pulse irradiation
- Use TEC fibers







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Planar Lightwave Circuit vs. Electric Circuit





#### Possible application



### Stress tolerance test

Tellurite glass melt

 is inserted into

 Silica glass ferule

 (ID : 126<sup>+3</sup><sub>-0</sub> μm) at 800°C

### No fracture if $\ell \leq 2mm$

• Can insert melt into sub-mm void







- Existing microsphares are to be improved.
  - Small Q-value due to small refractive index
  - Ununiformity of reheated glass powder
  - Fast deterioration of the dye
- Tellurite glass microcavity?





Optical Coupling Structure btw Silica Fibers & Tellurite Glass.

Fabrication method

*Even*  $TeO_2$  *melt is quenched* without precipitation.

**Optical performance** 

 $\sim$ **10dB loss** can be improved by **n-modulation**.

Possible application

Hybrid device where soft glass meets a-silica device.