Innovative Resin-Based Material with Advanced Ultra-Fine Machining Capabilities.

Yuki Sato

Mitsubishi Gas Chemical / Hiratsuka Research Laboratory

TestConX™

Mesa, Arizona ● March 2–5, 2025

MITSUBISHI GAS CHEMICAL

Contents

- Introduction
- Our development materials
- Details of ...
  TZ3300(Normal, Low Dk, Conductive, Low CTE)
- Conclusion

Four development policies

TZ3300 Standard Grade

- Low water absorption and minimal dimensional change.
- Highest CTI, ideal for high current sockets.
- Low dielectric constant for high frequency.
- High heat resistance for high temperature environments.

Conductive Grade

- Low resistivity offers anti-static performance, preventing short circuits and probe insertion/removal issues.
- Enables fine processing of 50µm or less.

New Materials Overview

Low Dk/Df grade

- Very low Dk and Df.
  ⇒ Suitable for high frequency sockets, reducing signal loss.
- Allows 100µm level processing.
- THERPLIM base resin ensures low water absorption and minimal Dk decrease.

Low CTE grade

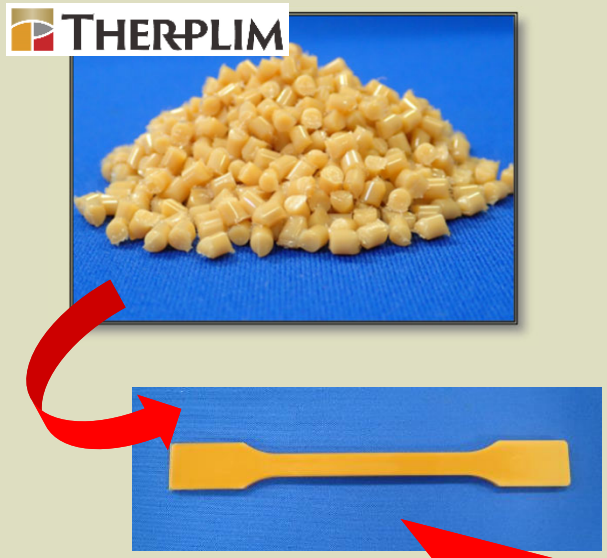
Concept Stage

- Targeting a CTE of 10 ppm or less as a ceramic replacement.
- Aiming for top laser and drill processability.

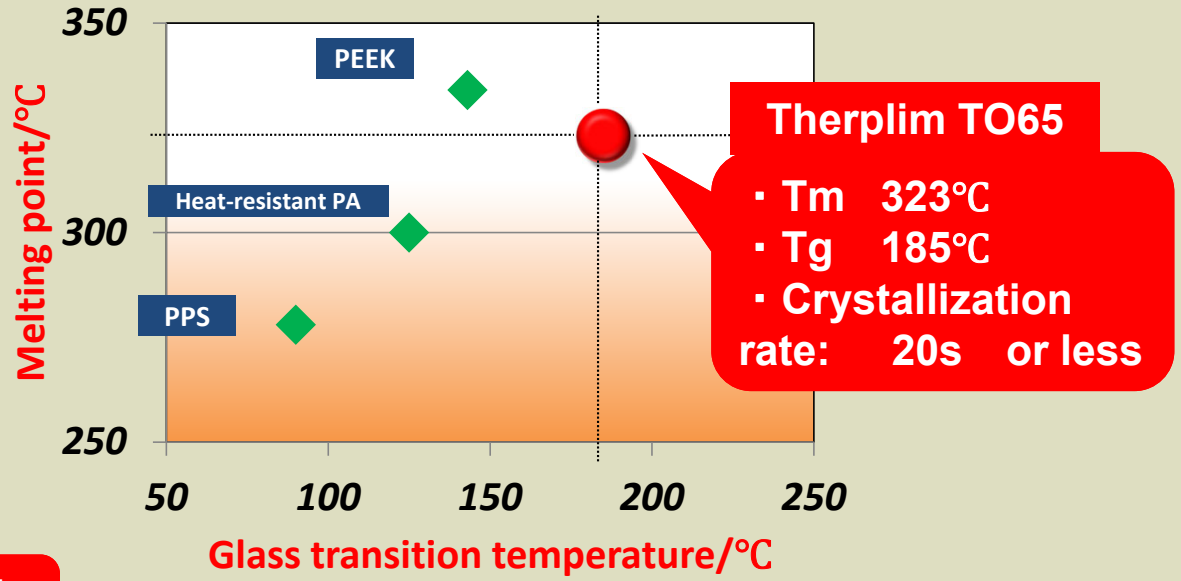
TestConX™

Innovative Resin-Based Material with Advanced Ultra-Fine Machining Capabilities. 3 2025

Thermophysical properties of Therplim



Various molding methods including injection molding are possible.



Therplim TO65

- Tm 323℃
- Tg 185℃
- Crystallization rate: 20s or less

TestConX™

Innovative Resin-Based Material with Advanced Ultra-Fine Machining Capabilities.

4

2025

Micromachining grade development concept

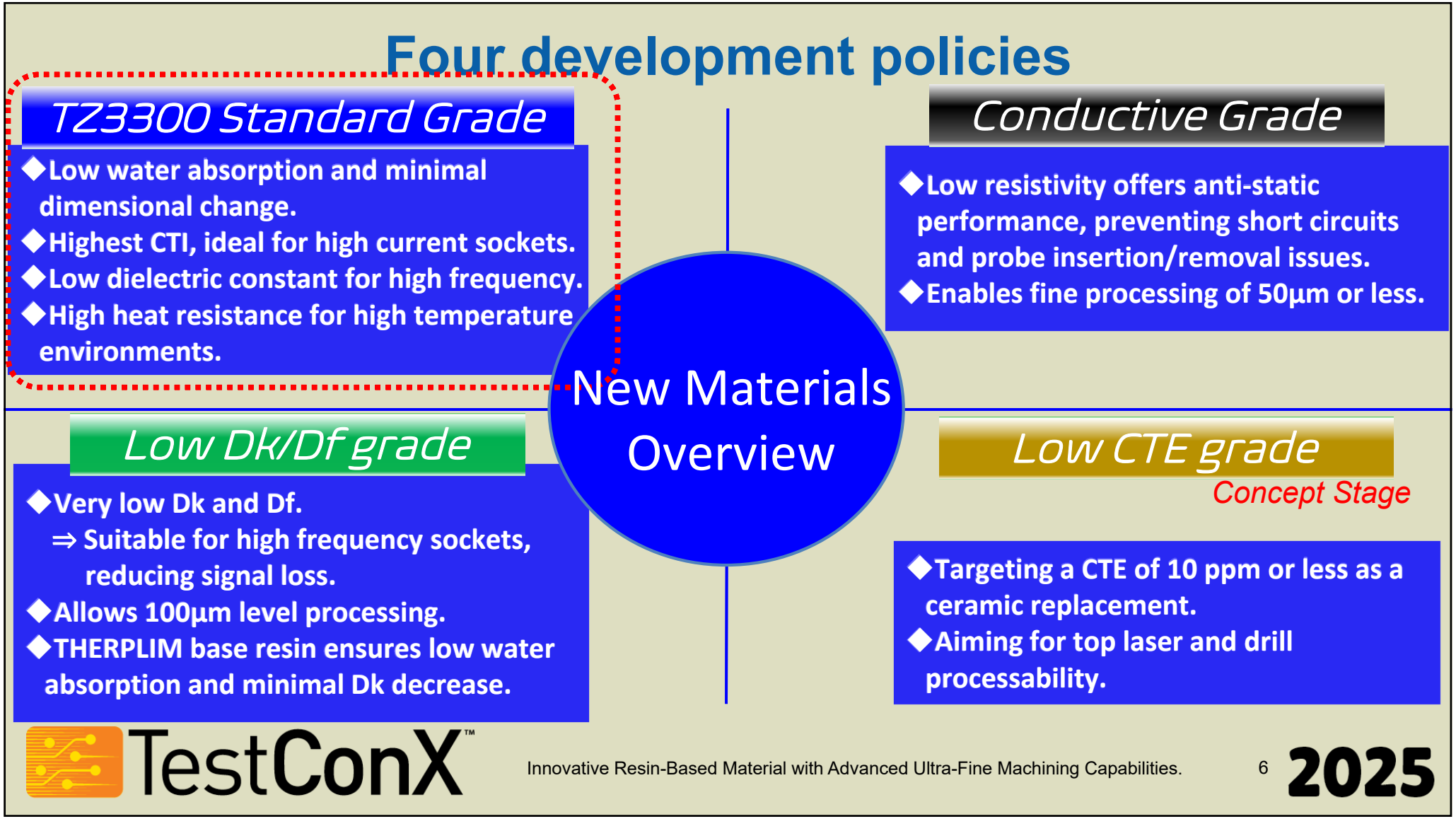
✓High Tm/Tg resin.
✓Low water absorption
✓Good electrical properties
etc.

+ Special Ceramics

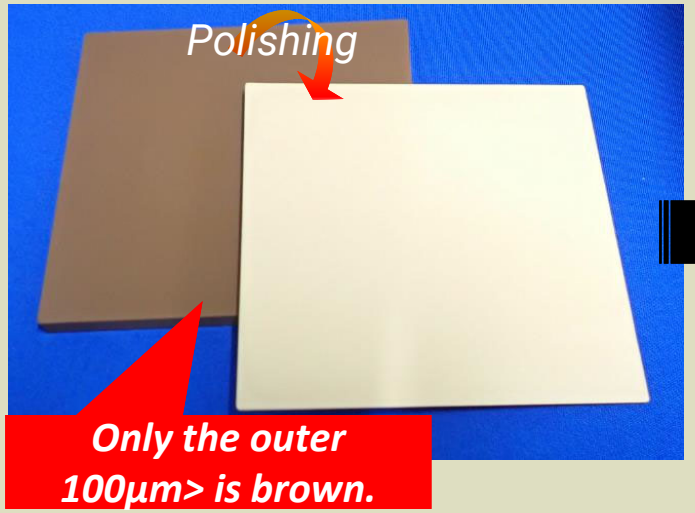
+ MGC compounding technology

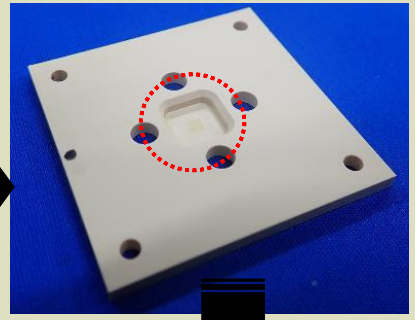
＝We are developing various new fine-processing base materials for test sockets and more

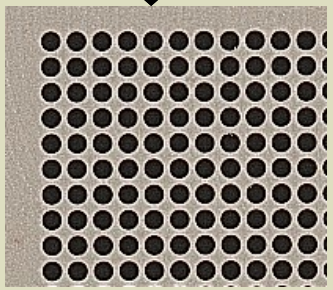
We introduce our proven main grade, new grades in sample work, and next-generation grades planned for development.


Four development policies
TZ3300 Standard Grade
◆Low water absorption and minimal dimensional change.
◆Highest CTI, ideal for high current sockets.
◆Low dielectric constant for high frequency.
◆High heat resistance for high temperature environments.
Conductive Grade
◆Low resistivity offers anti-static performance, preventing short circuits and probe insertion/removal issues.
◆Enables fine processing of 50µm or less.
New Materials Overview
Low Dk/Df grade
◆Very low Dk and Df.
⇒ Suitable for high frequency sockets, reducing signal loss.
◆Allows 100µm level processing.
◆THERPLIM base resin ensures low water absorption and minimal Dk decrease.
Low CTE grade
Concept Stage
◆Targeting a CTE of 10 ppm or less as a ceramic replacement.
◆Aiming for top laser and drill processability.
TestConX™
Innovative Resin-Based Material with Advanced Ultra-Fine Machining Capabilities.
6
2025

Machining example of TZ3300 【 Drilling 】







✓Processing of 50μm or less is also possible
✓No burrs or chips

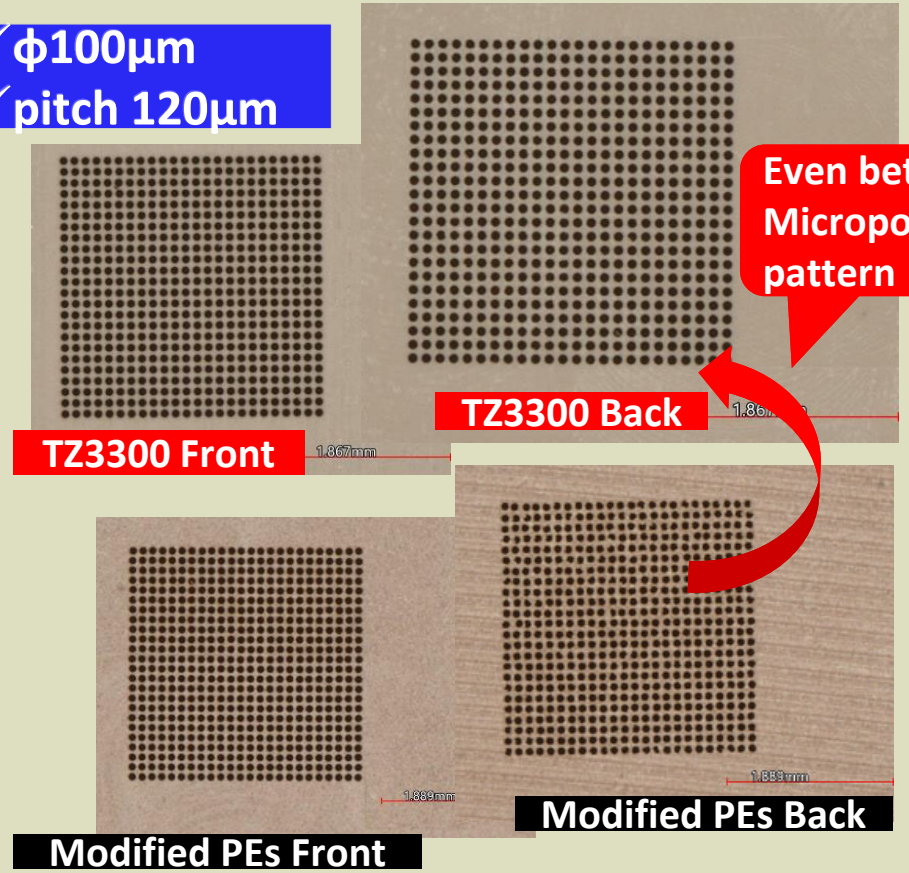
◆Thinner thicknesses of 0.8, 0.4 mm are also available.

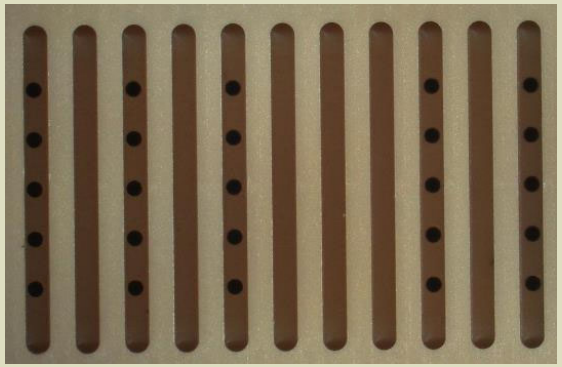
	TZ3300	PEEK base
CTI (comparative tracking index)	600V (Highest Rating)	150~200V
Water absorption (23℃/24h in water)	0.06%	0.08%

●Suitable for standard test sockets as well as high-current test sockets.

Machining example of TZ3300 【 Drilling 】

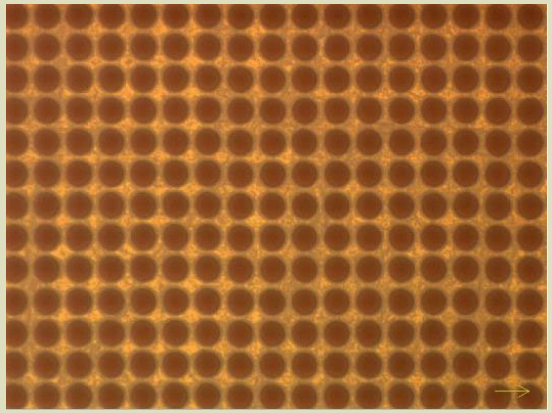
✓ϕ100μm
✓pitch 120μm



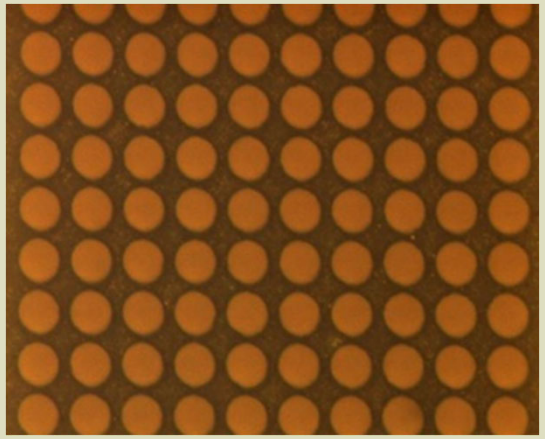


✓Camera module connector test socket
✓Line width 120μm

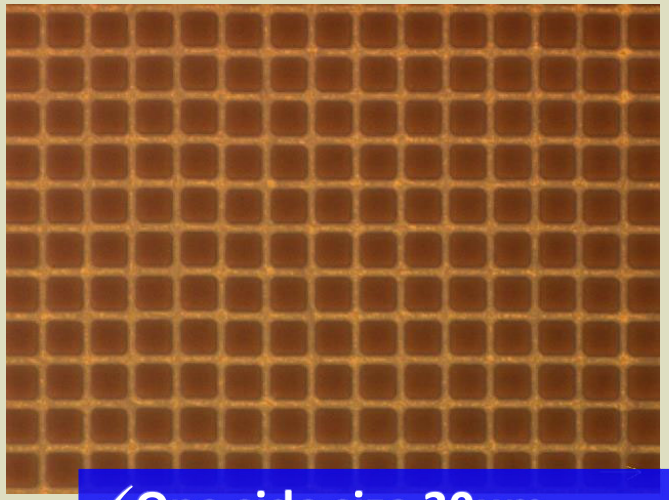
Machining example of TZ3300 【 Laser 】



✓ϕ25μm
✓pitch 32μm
✓No burrs or chips



✓ϕ20μm
✓pitch 26μm
✓No burrs or chips

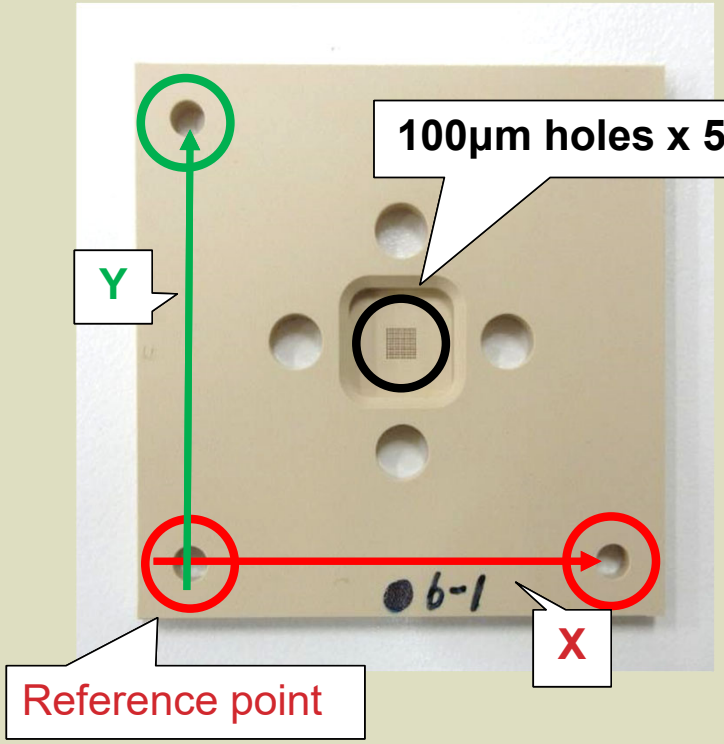


✓One side size 30μm
✓Partition wall thickness 7μm
✓Achieved R6

●**Laser processability is also good.**

Customer evaluations showed that it had the same laser processability as ceramic.

Results related to reliability

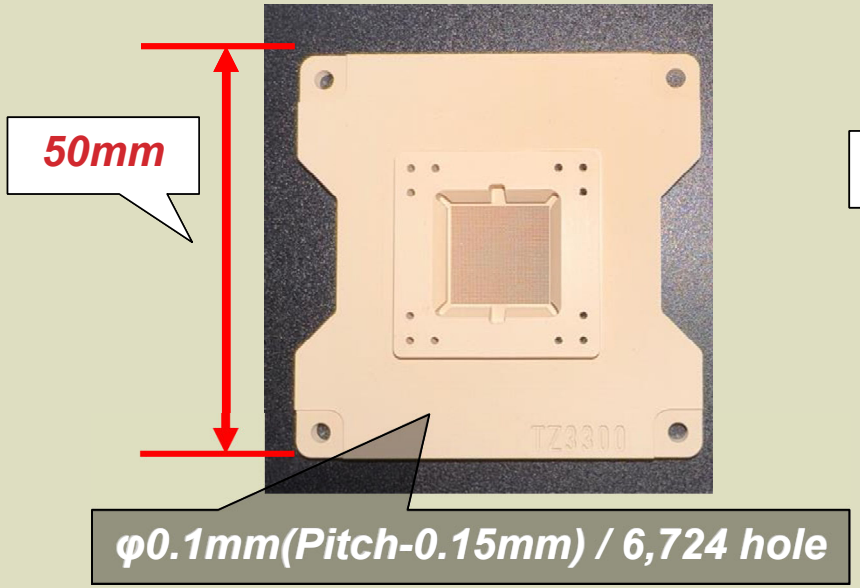


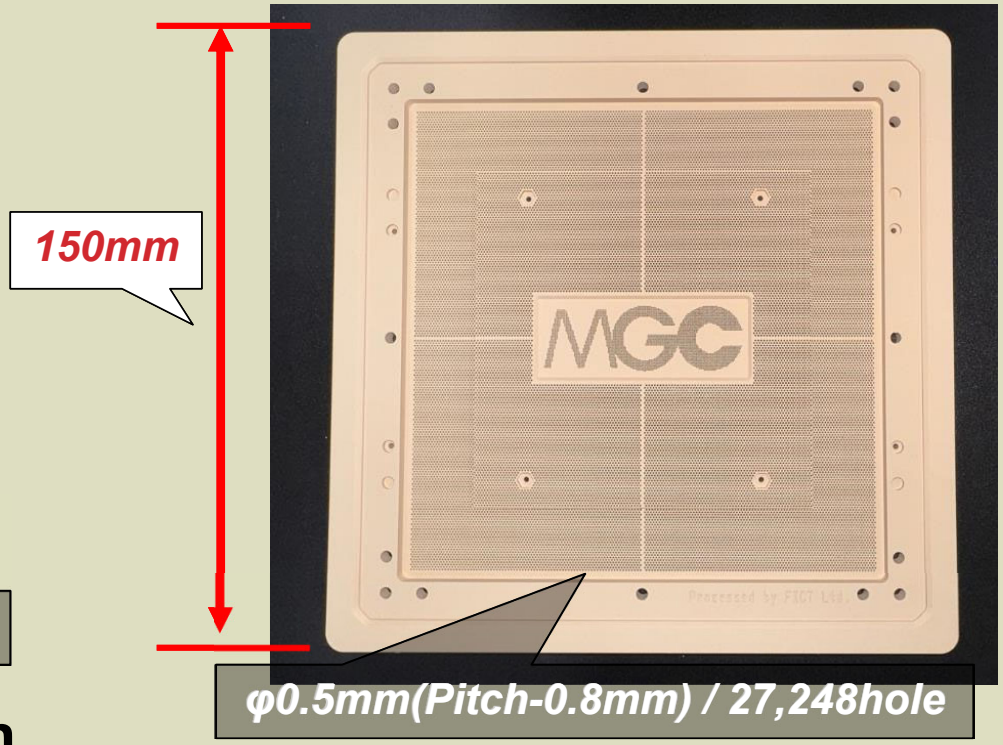
Exposure temp. /96h	150℃	175℃	200℃
Hole diameter Variation/ Initial 100μm hole	1μm>	1μm>	1μm>
Y-distance retention rate	99.95%	99.95%	99.91%
X-distance retention rate	99.96%	99.93%	99.87%

●In temperatures above 175℃, dimensional variation is minimal.

Processing sample at customer

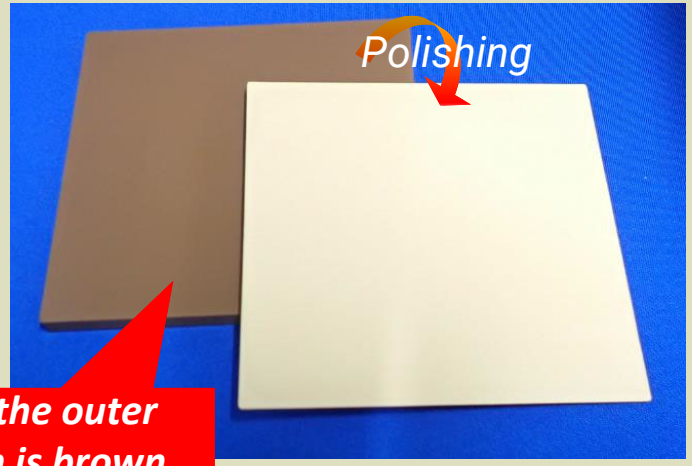
Provided by FICT Co., Ltd.

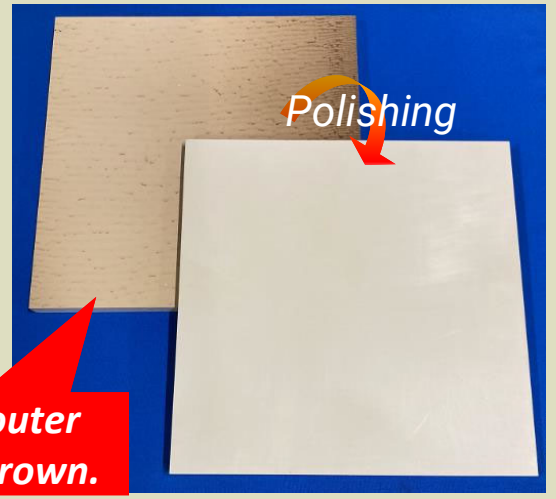




●Excellent microfabrication.
Implementation testing are also underway at other customers.

Various molding processability





Injection type
- 70mm square x 4mm thick
- 100mm square x 6mm thick
- 150mm square x 10mm thick

※under development

Extrusion type
- 200mm square x 10mm thick
- 250~500mm square x 10mm thick

※under development

●Various thickness adjustments (0.4, 0.8, 1.0mm, etc.) are also possible.

Four development policies

TZ3300 Standard Grade

- Low water absorption and minimal dimensional change.
- Highest CTI, ideal for high current sockets.
- Low dielectric constant for high frequency.
- High heat resistance for high temperature environments.

Conductive Grade

- Low resistivity offers anti-static performance, preventing short circuits and probe insertion/removal issues.
- Enables fine processing of 50µm or less.

New Materials Overview

Low Dk/Df grade

- Very low Dk and Df.
  ⇒ Suitable for high frequency sockets, reducing signal loss.
- Allows 100µm level processing.
- THERPLIM base resin ensures low water absorption and minimal Dk decrease.

Low CTE grade

Concept Stage

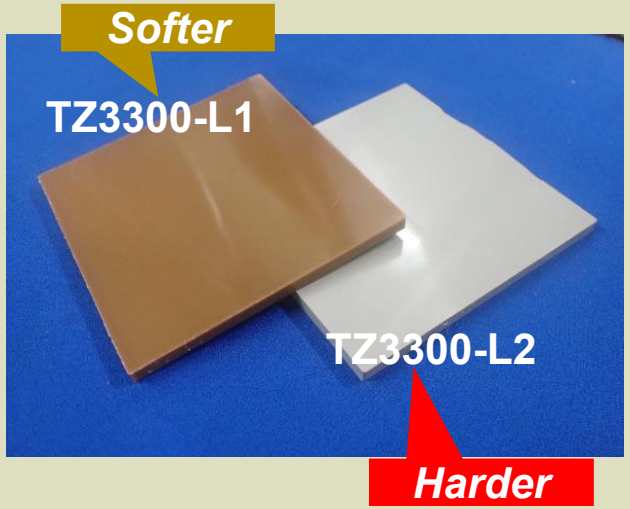
- Targeting a CTE of 10 ppm or less as a ceramic replacement.
- Aiming for top laser and drill processability.

TestConX™

Innovative Resin-Based Material with Advanced Ultra-Fine Machining Capabilities. 13 2025

Characteristics of the TZ3300-L 【Low Dk/Df grade】

	TZ3300-L1	TZ3300-L2
Permittivity (*Dk*)	2.67	2.67
Loss tangent (*Df*)	0.0028	0.0035
CTI (V)	≧600	550
Microfabrication	Ex	Ex～Good
color	Brown	Light Gray

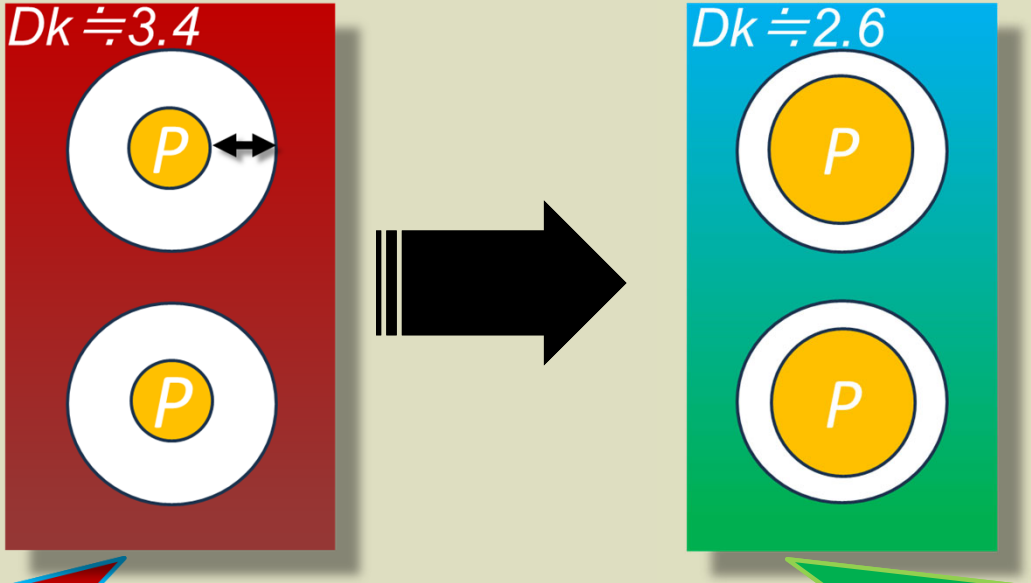


✓ Sample size 100×100×6mm thick

Measurement method: Cavity resonator method (10GHz)
Test Equipment: Keysight P5008A 53GVNA
Measurement conditions: 23℃/50%Rh
Measurement size: 1mm×2mm×70mm (Cutting from plate)
Number of measurements: n=2

● This is a new special material that combines low dielectric properties with fine processability.

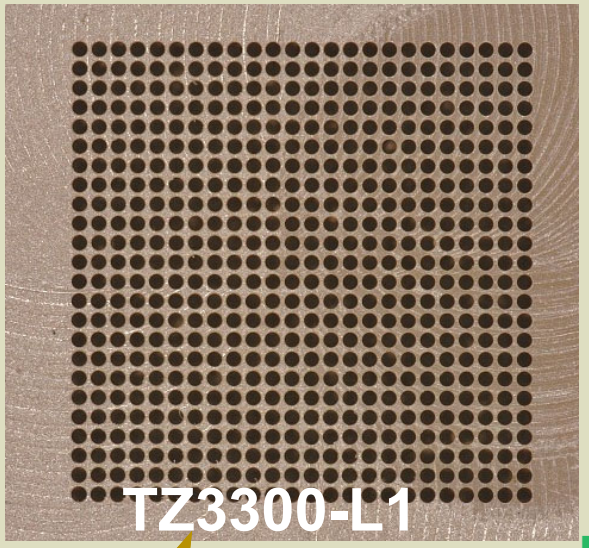
Advantages of low Dk materials

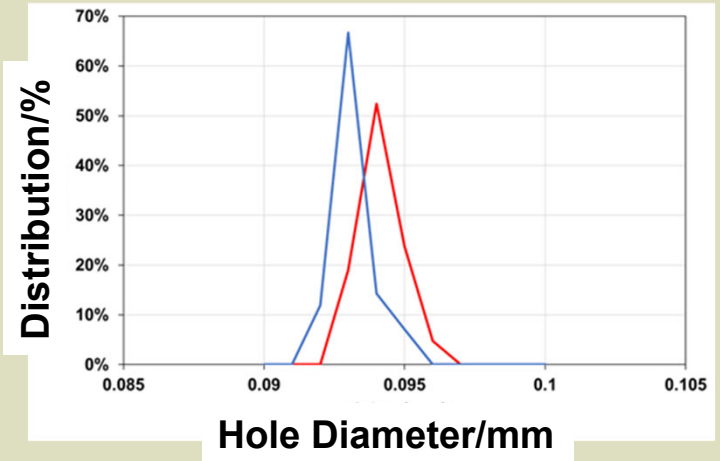


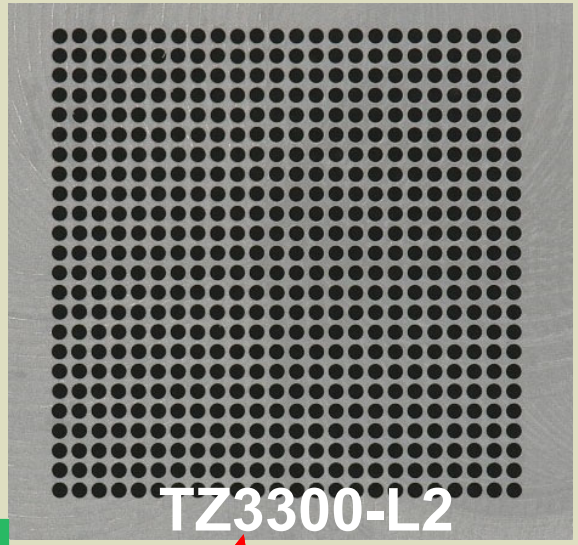
Gap needed between probe and resin
⇒ Thinner pins, higher costs
⇒ Miniaturization leads to design limits

- ✓ Thicker probes possible
- ✓ Increased design flexibility
- ✓ Supports further miniaturization
- ✓ Enables low loss

Machining example of TZ3300-L 【 Drilling 】



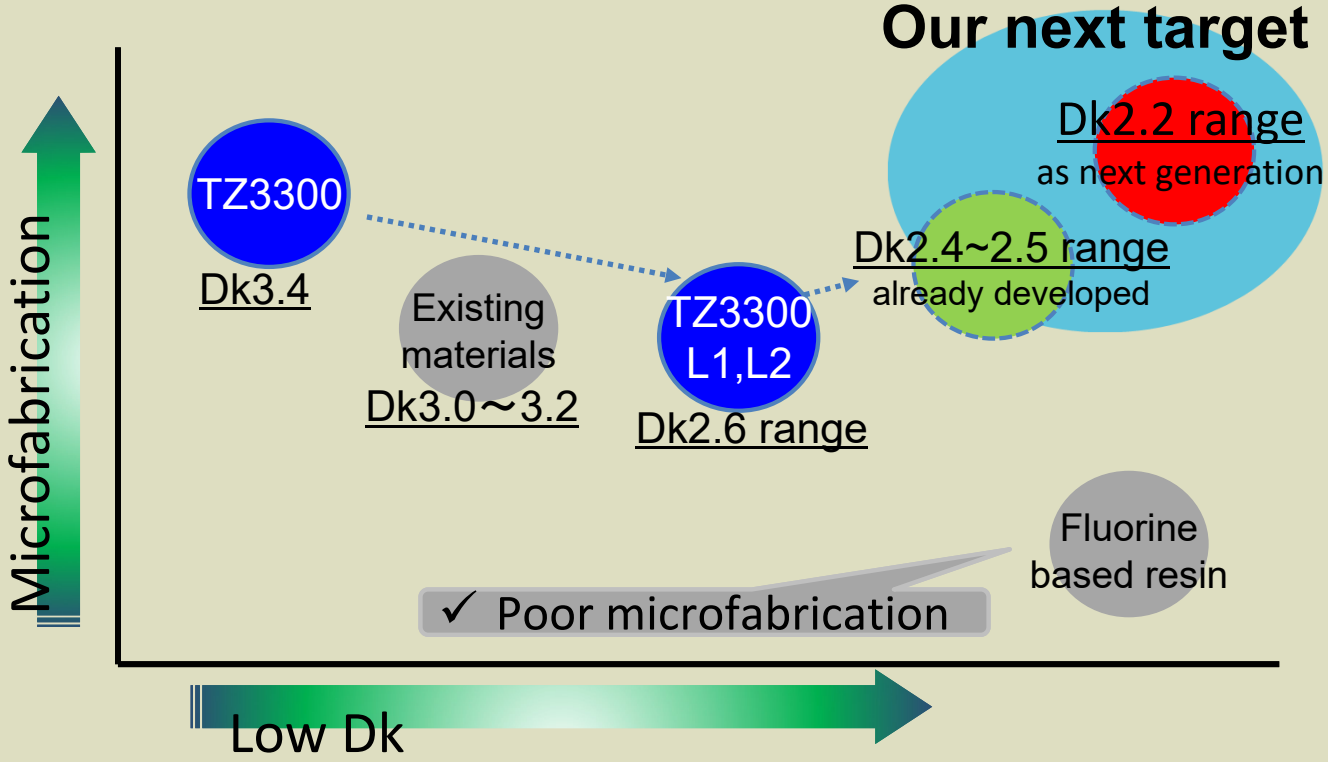




✓ϕ100μm/pitch 120μm
✓No burrs or chips

- This is a new special material that combines low dielectric properties with fine processability.

Development plan for low Dk grade



- Customer evaluation in progress on RF (Radiofrequency) test sockets.

Four development policies

TZ3300 Standard Grade

- Low water absorption and minimal dimensional change.
- Highest CTI, ideal for high current sockets.
- Low dielectric constant for high frequency.
- High heat resistance for high temperature environments.

Conductive Grade

- Low resistivity offers anti-static performance, preventing short circuits and probe insertion/removal issues.
- Enables fine processing of 50µm or less.

New Materials Overview

Low Dk/Df grade

- Very low Dk and Df.
  ⇒ Suitable for high frequency sockets, reducing signal loss.
- Allows 100µm level processing.
- THERPLIM base resin ensures low water absorption and minimal Dk decrease.

Low CTE grade

Concept Stage

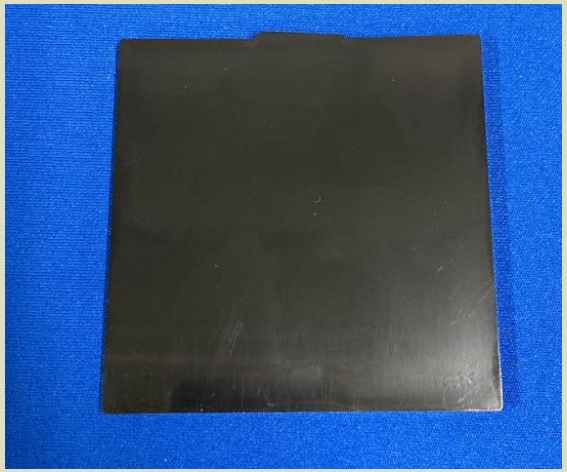
- Targeting a CTE of 10 ppm or less as a ceramic replacement.
- Aiming for top laser and drill processability.

TestConX™

Innovative Resin-Based Material with Advanced Ultra-Fine Machining Capabilities. 18 2025

Characteristics of the TZ3300-E 【Conductive Grade】

- ✓ only Black color
- ✓ Sample size 70×70×4mm thick



Test equipment: Honest Meter S-5109
(Shishido Electrostatic Co., Ltd.)
Test piece size: 45mm x 45mm
Applied voltage: -10kV
Pretreatment: 24h/22±1℃/60±5%RH
Measurement environment: 22℃/59%RH
Number of measurements: n=2

	TZ3300	TZ3300-E
surface resistivity (Ω)	3×10^{15}	2×10^{6}
volume resistivity (Ω・cm)	5×10^{15}	8×10^{5}

Significantly reduces resistivity without compromising TZ3300's processability or properties

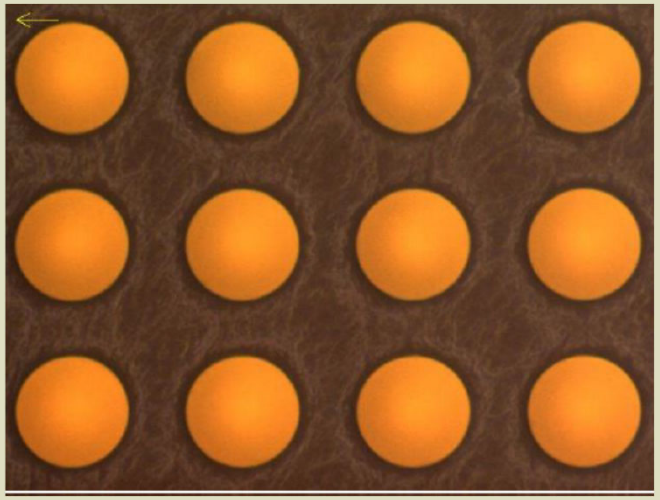
	TZ3300	TZ3300-E
30s charging voltage(kV)	2.26	0.02
Voltage after 120s discharge(kV)	2.24	0.00

0.1 kV or less eliminates static electricity effects in precision equipment.

TestConX™

Machining example of TZ3300-E 【 Drilling 】

Pore size 42μm



- Generally, formulations that lower resistivity often reduce processability.
  TZ3300-E achieves both low resistivity and good processability.

Four development policies

TZ3300 Standard Grade

- Low water absorption and minimal dimensional change.
- Highest CTI, ideal for high current sockets.
- Low dielectric constant for high frequency.
- High heat resistance for high temperature environments.

Conductive Grade

- Low resistivity offers anti-static performance, preventing short circuits and probe insertion/removal issues.
- Enables fine processing of 50µm or less.

New Materials Overview

Low Dk/Df grade

- Very low Dk and Df.
  ⇒ Suitable for high frequency sockets, reducing signal loss.
- Allows 100µm level processing.
- THERPLIM base resin ensures low water absorption and minimal Dk decrease.

Low CTE grade

Concept Stage

- Targeting a CTE of 10 ppm or less as a ceramic replacement.
- Aiming for top laser and drill processability.

TestConX™

Innovative Resin-Based Material with Advanced Ultra-Fine Machining Capabilities. 21 2025

Concept of the TZ3300-S 【Low CTE Grade】

・Required characteristics of the base material for the probe head….
⇒Low CTE *(Coefficient of Thermal Expansion)* / less than 10ppm
⇒Low Water absorption
⇒Good laser and Drill processability
・The performance requirements are high, and ceramics are used in most cases.

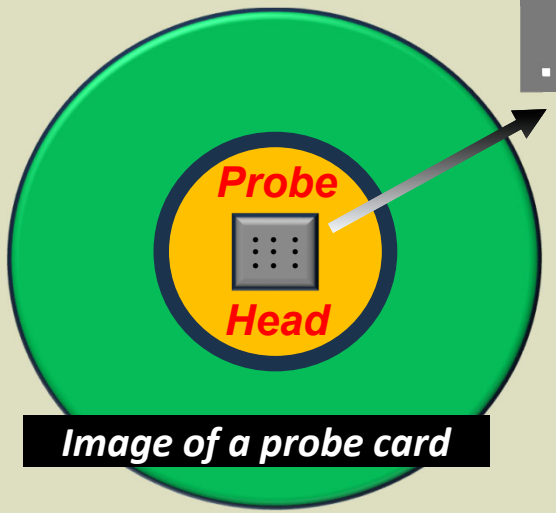


Image of a probe card

THERPLIM

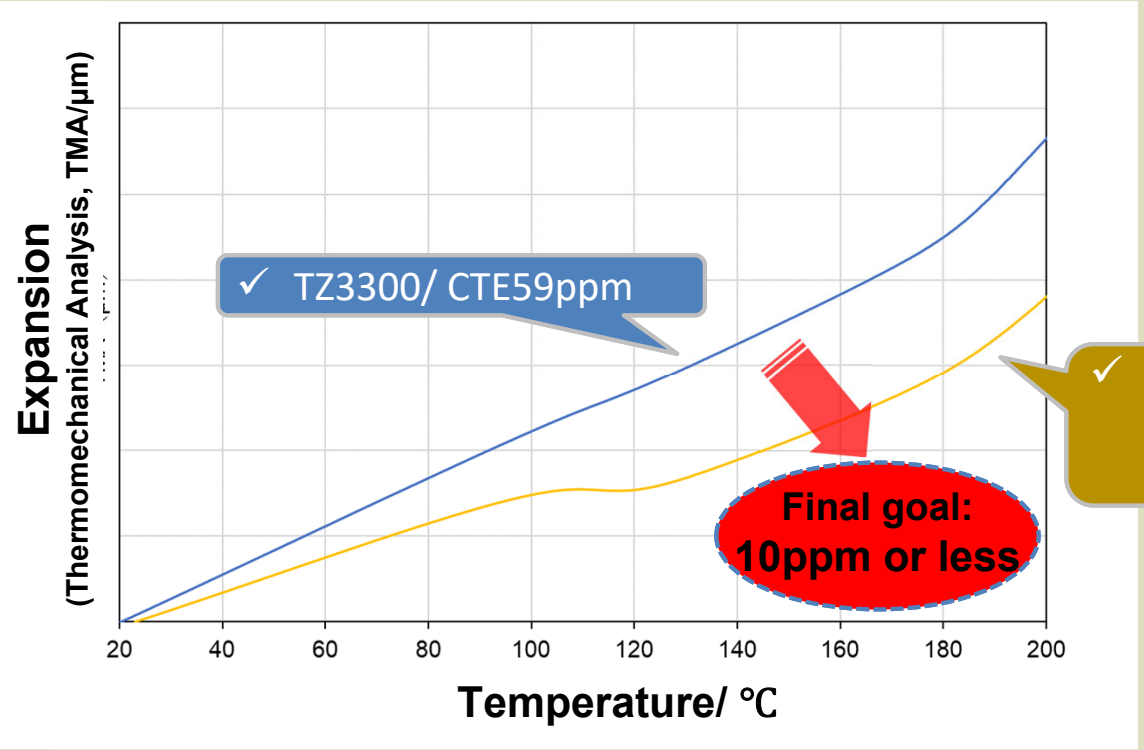
+ Special Ceramics + MGC compounding technology

＝We will soon be offering a ceramic alternative

TestConX™

Innovative Resin-Based Material with Advanced Ultra-Fine Machining Capabilities.

Concept of the TZ3300-S 【Low CTE Grade】

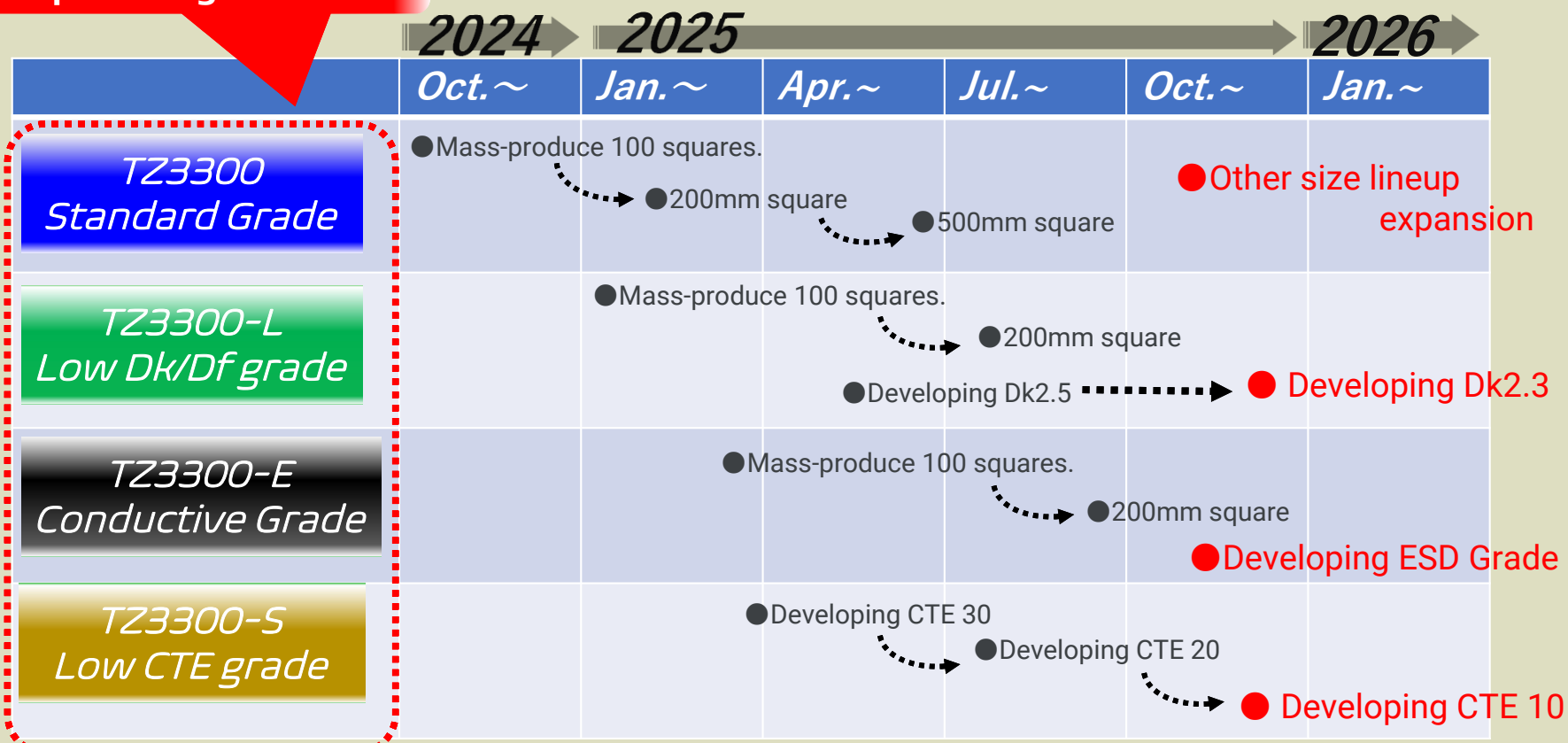


✓ Current Development Status /TZ3300-s early sample / Around 40 ppm

● Development started this fall, aiming for completion next year and beyond.

Conclusion

We have developed or plan to develop these grades.



TestConX™

Innovative Resin-Based Material with Advanced Ultra-Fine Machining Capabilities.

Presentation / Copyright Notice

The presentations in this publication comprise the pre-workshop Proceedings of the 2025 TestConX workshop. They reflect the authors' opinions and are reproduced here as they are planned to be presented at the 2025 TestConX workshop. Updates from this version of the papers may occur in the version that is actually presented at the TestConX workshop. The inclusion of the papers in this publication does not constitute an endorsement by TestConX or the sponsors.