

PRODUCT CATALOGUE / / / CAT-003

Adaptive Glass-Ceramic

AGC-01

The material *adapts*. Your design doesn't.

POSITION / / / CAT-003

Expansion is a **design input.**

NEGATIVE THERMAL EXPANSION / / / READY-TO-FIRE POWDER BLEND / / / CUSTOMER-FORMED / / / ITAR-FREE

In most material selections the coefficient of thermal expansion is a fixed property you design around. Adaptive Glass-Ceramic contracts continuously over the entire 100 to 800 °C range, giving it a net negative coefficient of thermal expansion. That negative expansion is used to offset the positive expansion of alumina, so the net coefficient of the fired body is set by the proportion in which the two are combined: from the continuous negative behaviour of the unmodified blend up to near-zero.

The material is delivered as a dry, ready-to-fire powder blend proportioned to the agreed target; you shape and fire the final geometry on your own tooling. Alternatively, you take the standard blend and combine it with your own alumina in-house, setting the net coefficient at the point of use and retaining the ability to change it between batches.

01 / / / TUNING

Tuning

Net expansion set by blend proportion, from approx. $-5.8 \times 10^{-6}/K$ (mean, 25 to 780 °C) to near-zero. Targets are agreed and verified by dilatometry on a trial specimen before series supply.

02 / / / THERMAL SHOCK

Thermal shock

Specimens heated to 800 °C and above and quenched repeatedly into water at 20 °C retain their structural integrity. On rapid cooling a negative-expansion body develops a stress state opposite in sign to that of a conventional ceramic.

03 / / / EXPORT

Export

ITAR-free across the supply chain. No United States export licence sits between a purchase order and a delivered lot.

SET PER CUSTOMER PROCESS

- / Target net expansion coefficient and its sign
- / Operating window within the measured 100 to 800 °C range

- / Ready-to-fire blend, or standard blend for in-house adjustment
- / Firing schedule, issued per project



STR-TDS-AGC-01 / / / AGC-01

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SPECIFICATION / / / STR-TDS-AGC-01

Adaptive Glass-Ceramic AGC-01

NEGATIVE THERMAL EXPANSION / / / READY-TO-FIRE POWDER BLEND / / / CUSTOMER-FORMED / / / ITAR-FREE

STATUS

Development material. Data obtained on laboratory batches by push-rod dilatometry on a sintered specimen; CTE values are mean (secant) coefficients over the stated interval and are indicative. Programme qualification is pending.

PUSH-ROD DILATOMETRY / / / WATER-QUENCH TEST / / / GRAVIMETRIC

DELIVERY AND HANDLING

- / Dry, ready-to-fire powder blend. Finished blanks are not supplied; the customer forms and sinters the final geometry in their own process.
- / Firing schedule issued per project, defined against the customer application and the target CTE.
- / Sealed container with PE liner; batch and revision identified on the label. Store sealed and dry, 5 to 35 °C; shelf life indefinite when stored sealed and dry.
- / The powder form contains a boron-based raw material; handling controls follow the Safety Data Sheet. Certificate of Analysis and SDS ship with every delivery.

KEY DATA

EXPANSION	Negative, 100 to 800 °C
STRAIN AT 780 °C	approx. -4.4×10^{-3}
MEAN CTE 25 TO 780 °C	approx. $-5.8 \times 10^{-6}/K$
MEAN CTE 25 TO 300 °C	approx. $-12 \times 10^{-6}/K$
MEAN CTE 300 TO 780 °C	approx. $-2.3 \times 10^{-6}/K$
THERMAL SHOCK	800 to 20 °C, repeated
COMPOSITION	$\alpha\text{-Al}_2\text{O}_3$ + boron-based additive
FORM OF SUPPLY	Ready-to-fire powder blend

MEAN (SECANT) CTE, PUSH-ROD DILATOMETRY ON SINTERED SPECIMEN
/ / / FULL SPECIFICATION STR-TDS-AGC-01

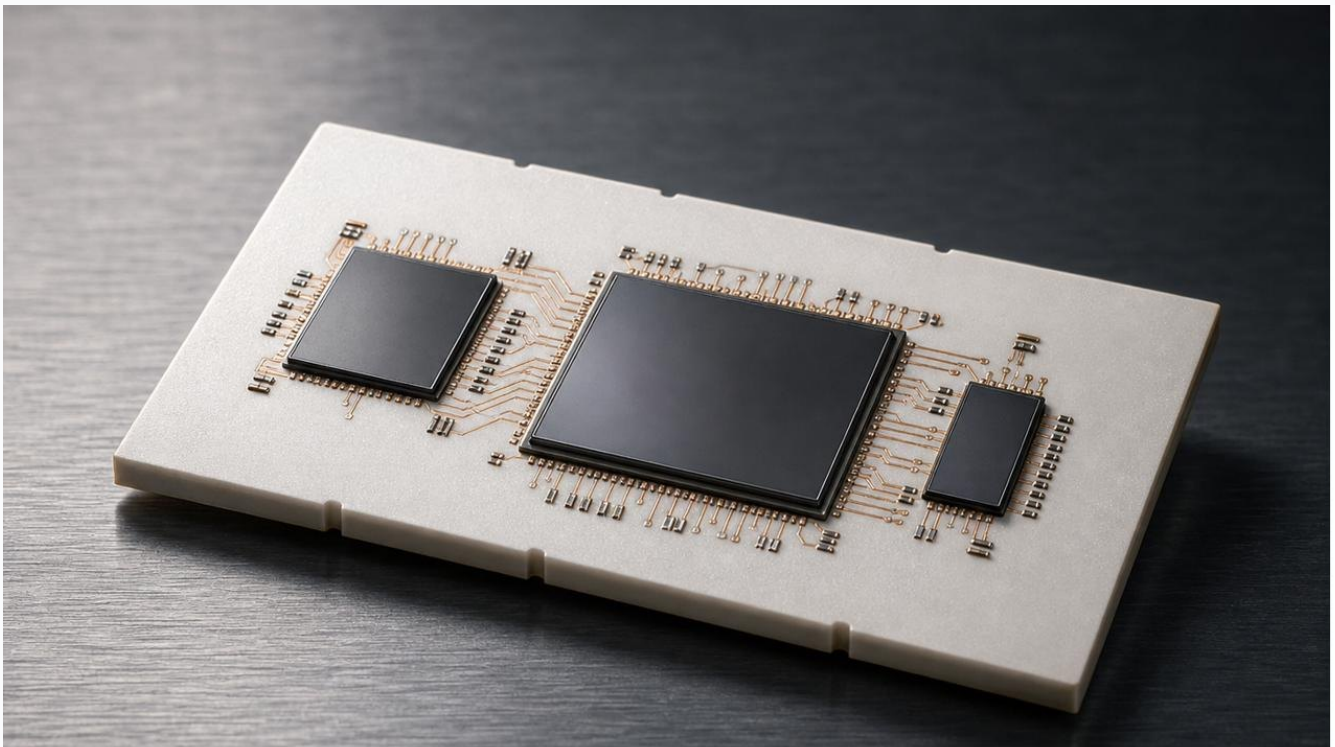
NOTES

- / Behaviour above the measured range (> 800 °C) has not been established; softening or viscous flow of the glassy phase should be assumed to limit the service envelope.
- / The dilatometric curve was recorded over a single heating run. Users requiring dimensional stability under repeated cycling should confirm the reversibility of the contraction over the relevant number of cycles.
- / Chemical durability has not yet been assessed; boron-containing glassy phases can be susceptible to hydrolytic attack and to alkali or steam environments at temperature.
- / Not interchangeable with conventional alumina in joint and seal designs: the negative expansion changes the sign of the mismatch stress against metals and positive-expansion ceramics.

APPLICATIONS / / / CAT-003

In service

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HETEROGENEOUS INTEGRATION CARRIER

AI INFRASTRUCTURE

USE CASES

- / Smallsat optical bench
- / Satellite thermal stability
- / Ring laser gyroscope cavity
- / Inertial navigation components
- / Advanced packaging substrate
- / RF substrate
- / Silicon photonics interconnect
- / Power electronics substrate
- / Missile radome
- / Thermal-shock-resistant crucibles, fixtures and nozzles
- / Sealing and joining interlayers
- / Kiln and furnace furniture

REQUIREMENT AND RESPONSE / / / CAT-003

What it **answers**

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The left column is the problem on your side. The right column names the sector flyer that carries the full mapping.

REQUIREMENT	MATERIAL RESPONSE	SECTOR / / / FLYER
Expansion mismatch between die, substrate and frame	Net coefficient set by blend proportion, from approx. $-5.8 \times 10^{-6}/K$ mean (25 to 780 °C) to near-zero; verified by dilatometry on a trial specimen before series supply.	AI INFRASTRUCTURE / / / AN-003
Cavity length stability in a ring laser gyroscope	Coefficient set toward near-zero across the operating window; measured range 100 to 800 °C.	AEROSPACE / / / AN-004
Optical alignment held through orbital thermal cycling	Expansion tuned to the bench design rather than the bench designed around the material; reversibility of the contraction confirmed over the cycle count relevant to the mission.	SPACE / / / AN-002
Survival of a severe thermal transient	Survives repeated 800 °C to 20 °C water quench in the in-house test; recorded video of the tests is published.	DEFENCE / / / AN-001

PROCESS / / / CAT-003

Specification first

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FORMULATION / / / CHARACTERIZATION / / / VALIDATION / / / DELIVERY

01 / / / FORMULATION

Formulation

Your specification is the starting point. Composition, particle distribution and thermal behaviour are set against your process, not selected from a grade list.

02 / / / CHARACTERIZATION

Characterization

Every formulation is measured before it ships: phase by X-ray diffraction, particle size by laser diffraction, morphology by SEM, to the methods named on the datasheet.

03 / / / VALIDATION

Validation

Sintered and thermal properties are tested to the ASTM method where one applies. Where a test is documented on video, the record travels with the material.

04 / / / DELIVERY

Delivery

Powder blend or simulant in a sealed, lined container, batch and revision on the label. A Certificate of Analysis and a Safety Data Sheet ship with every delivery. ITAR-free across the supply chain.



Bring your *specification*.

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FULL SPECIFICATION / / / STR-TDS-AGC-01