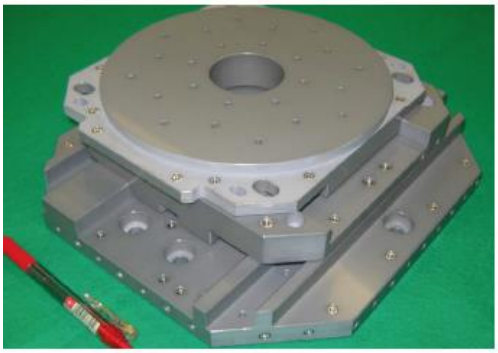
Sialon

Ceramics with Low Thermal Expansion & High Stiffness

Cactus Materials
LIMITLESS POSSIBILITIES

Sialon ($Si_{6-z}Al_zO_zN_{8-z}$, Z=0~4) is a Si_3N_4 based ceramic featuring superior strength at high temperatures. We additionally researched the benefits inherent to Sialon at room temperature and discovered its superior shape stability performance. This can be seen in sialon's low thermal expansion, high stiffness and low weight. Since then we have continued to develop applications that maximize the potential of sialon as including application in structural components of stages for LSI lithography. A recent development has been the adoption of Sialon in ultra precision machine tools and measuring instruments.



Work adjusting stage

ADVANTAGES

>>Low Thermal Expansion
Equal to invar alloy (as low as 1/10 of cast iron)

>>Low Weight
40% of cast iron

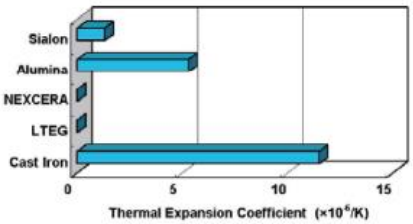
>>High Stiffness
2 times that of cast iron

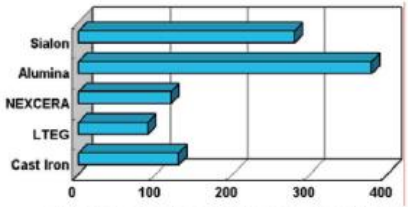
>>Easy to Achieve High Precision and Accuracy by General Working
Flatness, parallelism, roundness ≦ 0.5 μm

>>Nonmagnetic & Rust Free

>>High Wear Resistance
Free from burrs and scraches

COMPARISON OF FEATURES





*LTEG: Low Thermal Expansion Glass

CHARACTERISTICS

Materials		S110 High strength	S110H Pore-less High strength	S120 Standard	S150 Standard
Color		Light gray	Light gray	Light gray	Gray
Bulk Density	g/cm³	3.24	3.25	3.22	3.20
Young's Modulus	GPa	290	300	300	280
Poisson's Ratio		0.27	0.27	0.27	0.29
Flexural Strength @ RT	MPa	880	1180	690	590
Fracture Toughness (SEPB)	$MPam^{1/2}$	6.5	6.5	6.0	5.0
Hardness HV (98N)	GPa	14.5	14.7	12.7	12.7
Coefficient of Linear Thermal Expansion (α)	$\times10^{-6}$/K (23°C)	1.3	1.3	1.3	---
Thermal Conductivity @ RT	W/m·K	21	21	21	21
Specific Heat	J/g·K	0.68	---	0.63	---
Thermal Shock Resistance	⊿T°C	750	---	700	---
Electrical Resistivity @ RT	Ωcm	$>10^{14}$	$>10^{14}$	$>10^{14}$	

* The values given above are typical values obtained from reliable testing and should only be used for design guidance.

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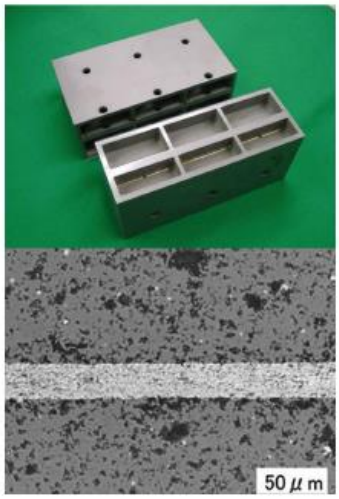
NEAR NET SHAPE SINTERING

Compacted green Sialon can be machined into a thin-ribbed structure in a near-net shape before sintering lowering manufacturing cost.

(3 mm rib structure after sintering)

BONDING METHOD



Sialon parts can be bonded to each other using our silver brazing technology.

The bonding layer is 50 μ m or thinner with a bonding strength equivalent to 70% of the bulk portion.

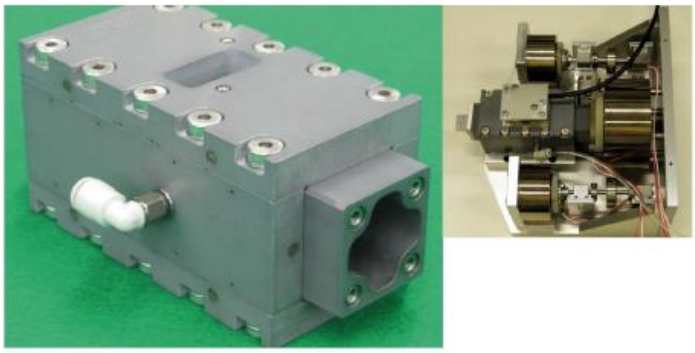
(Cross section of a joined-box)

APPLICATIONS

Sialon Slider & Stage

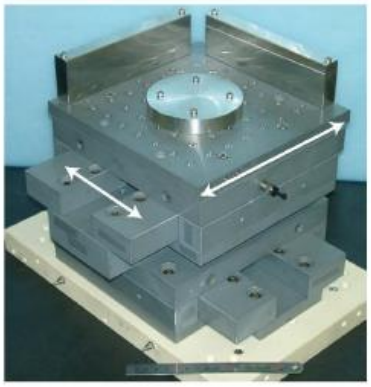
>> Dramatically **reduces thermal drift** in precision machines. Capable of **extended continuous operation**
>> High dimensional stability enables **high repeatability of action**
>> High stiffness and light promotes **enhanced gain of servo control**
>> High toughness eliminates cracking and chipping, **facilitating handling**

- Air hydrostatic bearing slider, guide bar, slide base, rotary table
- Oil hydrostatic bearing slider, guide bar, slide base, rotary table
- On machine measuring systems (small air slider) for ultra precision machine tools
- Vacuum chucks, work mounts, tool holders,
- Work adjusting stages



Fast tool servo (air slider)

Integrated measuring system



X-Y axis: Piled-up / T-type slide

310 x 310 x 184 (mm)
(stroke 100 mm)

Z-axis:
Drive a center of gravity

220 x 156 x 102 (mm)
(stroke 60 mm)

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