

## Mechanical and Apparatus Engineering



FCT Ingenieurkeramik GmbH represents 25 years of experience in the field of processing, fabrication and materials technology for high performance ceramics and composite materials.

### Silicon nitride ceramics for engineering application

In mechanical and apparatus engineering, silicon nitride materials are established or under evaluation for many applications.

#### For wear application

- Agitator arms, discs and inliners show excellent life times
- Guiding elements in cutting equipment shows no slide adhesion wear
- With inductive heated tubes, the hardening treatment of construction steel is improved
- Dosing valves, pistons and armatures are used in pressurised and highly corrosive flow control systems
- Silicon nitride gas seal rings are state of the art for gas seals in turbo compressor machinery
- High precision wear resistant pumping and dosing systems for corrosive media with a demand of complex components can be produced now

For **thermal engineering** corrosion and thermal shock resistant parts are used and tested:

- Thermal shock proof components
- Thermomechanically loaded components like heating tubes
- Support for heating wires and coils

In **electrical engineering** highly strong and thermal shock resistant components show improved service behaviour

- Insulators
- Separation and shielding plates

For **electronics** stiff and highly reliable components are required

- Guiding beams for chip manufacturing equipment
- Ceramic heater plates
- High precision tool for chip wiring
- Chucks for wafer handling and machining

In **optical engineering** lightweight, highly stiff and long-term durable components and structures with low CTE are needed

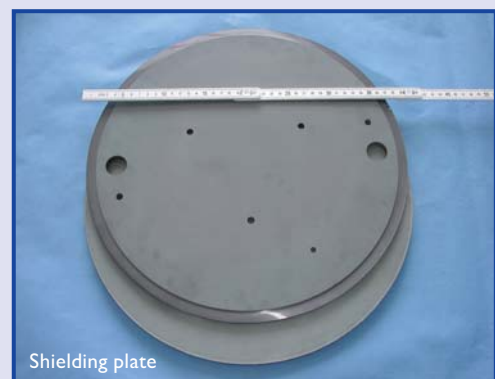
- Guiding beams for positioning systems
- Support and frame for lenses
- Housing structure for optical systems



Agitator arms



Housing structure for IR-camera



Shielding plate



Material		HPSN		GPSN		GPSN	HPSN	NSiC	SSiC	LPSiC
		HP	HP	ISO	SG	TiN	BN			
Sintering process		HP	HP	GPS	GPS	GPS	HP	RS	S	LPS
FCT-grade		FHNM	FHNY	FSNI	FSNS	FSNT	FSNB	FSNC	FSC	FSCL
Microstructure										
Bulk density	[g/cm <sup>3</sup> ]	3,22	3,23	3,26	3,21	4,35	2,4-3,0	2,8	3,15	3,25
Open porosity	[%]	0	0	0	0	0	2-12		<3	<1
Mechanical Properties										
Compressive strength	[MPa]	2.600	3.000	3.000	2.500	3.000	1.000	600	2.500	3.000
Bending strength $\sigma$ RT	[MPa]	700	850	750	650	850	500	180	400	500
1.200 °C	[MPa]	450	500	450	400				400	450
Weibull modulus m		>18	>20	>20	>20	>20	>20	20	15	15
Fracture toughness K <sub>IC</sub>	[MPa.m <sup>1/2</sup> ]	7	8	8	7	8	9	4	3,5	5
Youngs modulus E	[GPa]	315	320	320	310	350	250	220	400	410
Poisson Ratio $\nu$		0,29	0,28	0,28	0,28	0,20	0,25	0,20	0,20	0,20
Hardness (Vickers)	[GPa]	16	16	16	16	18			26	23
Thermal properties										
Max. working temp.										
- inert gas	[°C]	1.200	1.200	1.200	1.200	1.200	1.400	1.800	1.900	1.600
- air	[°C]	1.200	1.200	1.100	1.100	1.000	1.000	1.400	1.650	1.500
T melting/decomposition	[°C]	1.600	1.600	1.600	1.600	1.600	1.600	1.600	2.400	2.300
Thermal conductivity $\lambda$ RT	[W/mK]	30	30	30	30	30	50	20	100	90
CTE $\alpha$	[10 <sup>-6</sup> K]	3,2	3,2	3,2	3,2	6,0	3,0	5,0	4,5	5,0
Thermal shock param. R <sub>1</sub>	[K]	495	598	527	472	324	500	110	177	195
Thermal shock param. R <sub>2</sub>	[W/m]	14.839	17.930	15.820	14.150	9.714	25.000	2.530	17.700	17.560
Electrical properties										
spec. resistance RT	[ $\Omega$ cm]	10 <sup>10</sup>	10 <sup>10</sup>	10 <sup>11</sup>	10 <sup>11</sup>	10 <sup>5</sup>	10 <sup>10</sup>		10 <sup>1</sup>	10 <sup>5</sup>
1.000 °C	[ $\Omega$ cm]	10 <sup>7</sup>	10 <sup>7</sup>	10 <sup>7</sup>	10 <sup>7</sup>					

### Production of components

We produce ceramic components by cold isostatic pressing or slip casting of preforms, then subsequent green machining by turning, milling, drilling cutting with conventional and CNC- equipment before firing.

FCT Ingenieurkeramik offers the economic production of components with large dimensions, high complexity and narrow tolerances as prototype and in series. Diameters up to 450 mm and lengths up to 1300 mm were already produced and are state of the art.

We help you with materials selection, design and implementation into a metallic, refractory or plastic aggregate.

We produce components corresponding to customers design from different gas pressure sintered and hot pressed silicon nitride, nitride bonded silicon carbide and sintered, recrystallized and C-fiber-reinforced silicon carbide composites.

For very specific applications we even develop tailor made materials according to your requirements.

### Services

Additionally we offer services in sintering, hot pressing, cold isostatic pressing and ceramic processing.

**Ask your questions about ceramics – we find solutions for you!**