JTEKT

EXSEV

New Ceramic Ball Bearings for Electric Motors

Our newly developed, first in Japan ceramic material makes ceramic bearings available for more applications.

Ceramic rolling elements prevent electrical pitting in bearings for electric motors



- Our newly developed ceramic has only a slight difference in linear expansion coefficient[※] from the inner and outer ring material (bearing steel SUJ2), thus creating minimal internal clearances due to temperature change, allowing ceramic bearing use in an environment with a wide range of temperatures.

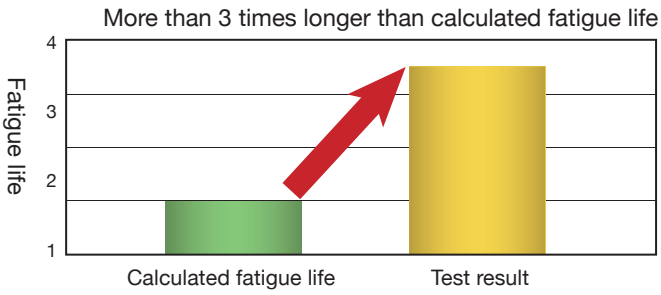
※Change in a material's length in response to a change in temperature of 1 degree Celsius.

- Our newly developed ceramic has similar insulation properties, strength, and durability (little change in acoustic value) with conventional silicon nitride material (Si_3N_4). (See the table below for details.)

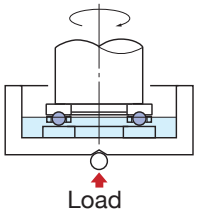
■ Material properties

	New ceramic	Bearing steel (SUJ2)	Standard ceramic (Si_3N_4)
Density (g/cm^3)	6	7.8	3.2
Linear expansion coefficient (1/°C)	10.5×10^{-6}	12.5×10^{-6}	3.2×10^{-6}
Vickers hardness (HV)	1280	750	1500
Module of longitudinal elasticity (GPa)	210	208	320
Poisson's ratio	0.31	0.30	0.29
3-point bending strength (MPa)	1200	–	1100
Fracture toughness (MPa·m$^{1/2}$)	5～6	–	6
Conductivity	Insulator	Conductor	Insulator

Rolling fatigue life evaluation results



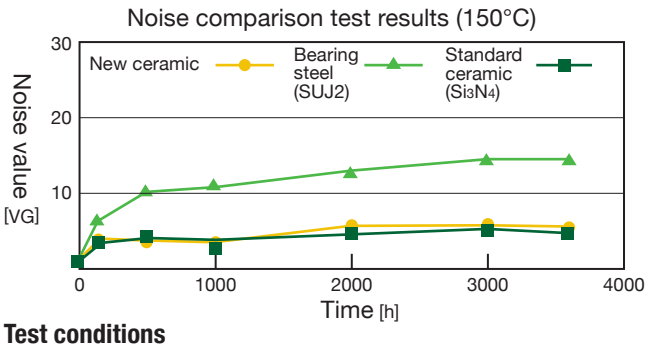
Test equipment



Test conditions

Contact stress	4.2 GPa
Lubrication	Oil bath

High-temperature Noise comparison test results

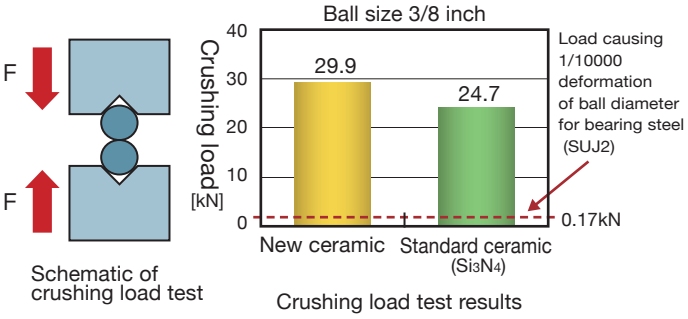


Test conditions

Lubrication	KVC (urea-based grease)
Ambient temperature	Outer ring temperature 150°C
Load	Fa=0.16kN
Rotational speed	3000 min^{-1}
Calculated grease life	3600 h
Test duration	3600 h

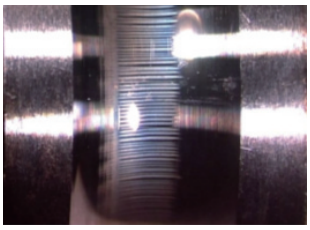
No significant deterioration of the acoustic value of our new ceramic after 3600 hours

Crushing load test

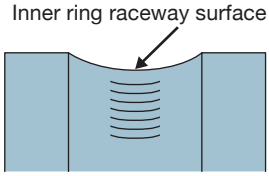


This new ceramic has strength equivalent to conventional silicon nitride ceramic (Si_3N_4).

Wave-like wear by electrical pitting



Inner ring raceway surface



【Electrical pitting】

Due to the nature of electric motors, harmful voltage is generated by high-frequency current during operation, and above a certain voltage can produce arcing between the bearing raceway surface and rolling elements. Electrical pitting occurs when a surface in rolling contact is locally melted due to the arcing, reducing bearing service life. To avoid such pitting, using an insulating ceramic rolling element is one of the most reliable solutions. Our newly developed ceramic has insulation properties equivalent to those of conventional silicon nitride ceramic (Si_3N_4).

Applications

- Inverter motors
- Fan motors

Inquiries:

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