

KES

Ceramics for Diesel Engine Swirl Chamber

KES B-T001

(EST.) 1987 - 10 - 30

Contents

1. Scope of Application
2. Quality
3. Testing Method
4. Inspection
5. Preservation of Test Result
Statement and Test Sample
6. Procedures Concerning New
Arrangement and Alterations.

Appendix



1. Scope of Application

This standard specifies silicon nitride ceramics (hereinafter referred to as "ceramics") for use in the swirlchamber of indirect injection for diesel driven automobiles.

2. Quality

Ceramics shall be tested according to the test method of 3. The quality shall in conform to the specifications of Tables 1, 2 and 3.

Table 1. Ceramic ingredient

Items		Specified value	Test method
Additive ratio wt.%	Ce	3.6 ± 0.3	3.2.1
	Mg	2.1 ± 0.2	
	Zr	1.2 ± 1.0	
	Sr	0.7 ± 0.1	
Impurities wt.%	Al	Max. 0.12	
	Fe	Max. 0.08	
	Ca	Max. 0.04	

Note (1) Chief ingredient is Si_3N_4 .

Table 2. Material property of ceramic

Heat fatigue by static weight min	800°C	$\bar{X} = 20$	3.2.3
Critical stress enlargement factor $M/m^{3/2}$	Normal temperature	$\bar{X} = 5.0 \text{ min}$	3.2.4
Specific heat $\text{Cal/g}^\circ\text{C}$ (KJ/kg.K)	Normal temperature	$\bar{X} = 0.15(0.63) - 0.20(0.84)$	3.2.5
Heat conductivity $\text{Cal/cm.sec.}^\circ\text{C}$ (W/m.K)	Normal temperature	$\bar{X} = 0.06(1.4) - 0.10(2.4)$	3.2.5

Table 3. Product characteristics of ceramic

Items		Specified value	Test method
Bending strength kgf/mm ² (N/mm ²)	Normal temperature	X = 65 (640) min X = 50 (490) min	3.2.2
	800°C	X = 60 (590) min X = 50 (490) min	
Superficial specific gravity	Normal temperature	3.04 - 3.36	3.2.6
Hardness HV	Normal temperature	X = 1050 - 1400	3.2.7
Oxidizing increment quantity mg	1200°C	Max. 70	3.2.8
Heat expansion factor 1/°C	40 - 800°C	3.10 - 3.80 x 10 ⁻⁶	3.2.9
Surface defects			3.2.10
Inner defects			3.2.11

3. Testing Method

3.1 General Items of Test Method

3.1.1 Standard condition

Temperature shall be class 15 at 20°C as specified in KS A 0006 (standard atmospheric condition of testing) that is, $20 \pm 15^\circ\text{C}$.

3.1.2 Room temperature and high temperature condition

If the room temperature is 800°C and 1200°C, the following conditions shall be marked:

- Room temperature : The temperature of $20 \pm 15^\circ\text{C}$
- 800°C : The temperature of $800 \pm 10^\circ\text{C}$
- 120°C : The temperature of $1200 \pm 15^\circ\text{C}$

Also, the test date, test room, and temperature shall be described in the test results statement.

3.1.3 Description of test results

Test results shall conform, in principle, to the methods specified in KES A-A003 (Round up method of numerical values).

3.2 Test Method for Ceramic Quality

3.2.1 Ingredient analysis

(1) Element analysis

Due to additives and impurities, the quantitative analysis shall be implemented individually against Ce, Zr, Sr, Mg, Al, Fe, Ca, etc.

(2) Analysis method

KES T-M018 (Quantitative method for ingredient analysis of ceramic materials) or a

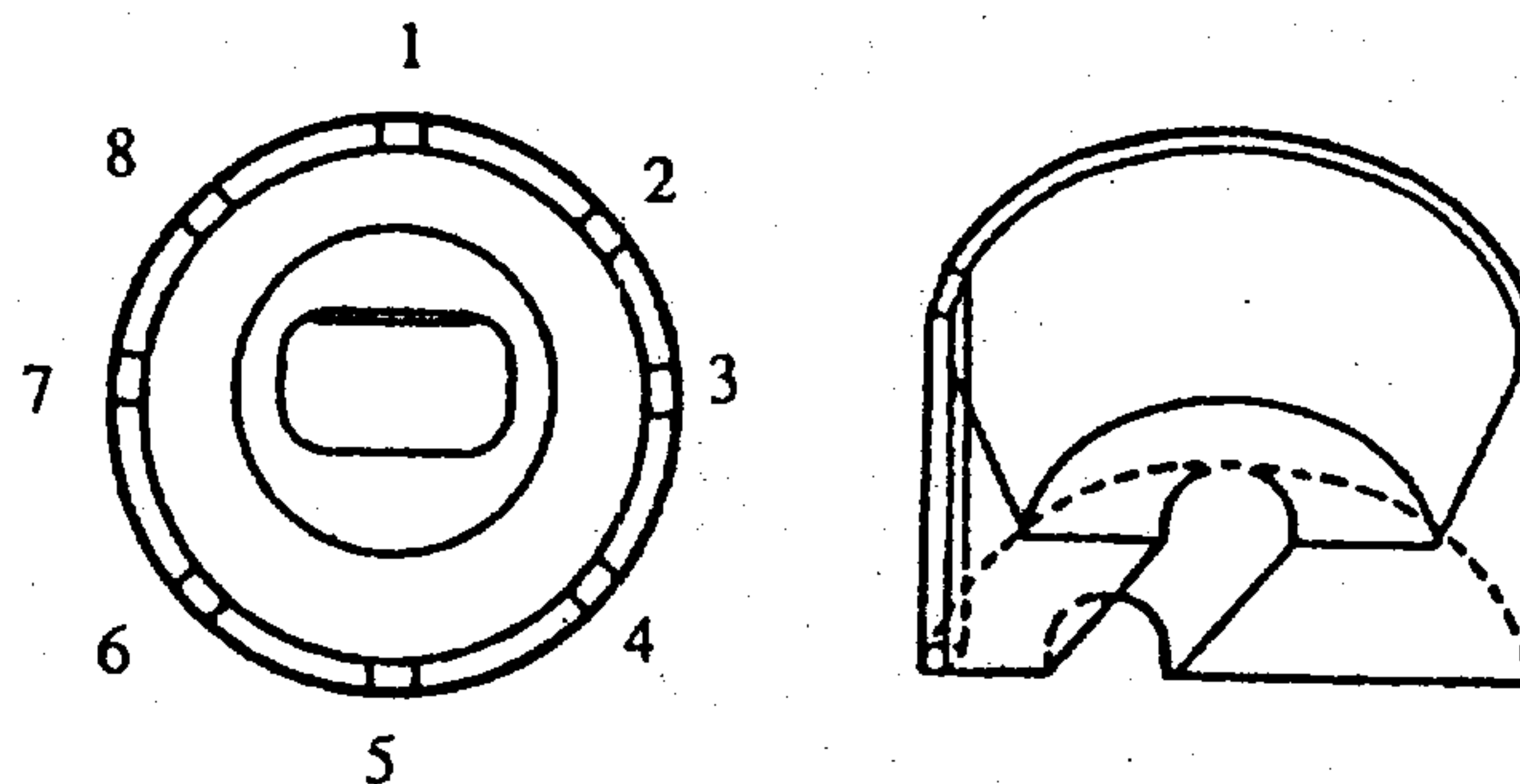
corresponding method shall be applied.

3.2.2 Bending strength

(1) Preparation of test piece

Test piece shall be taken from the lower ceramic area of the actual product. The position of the test piece shall be as shown in Figure 1.

Figure 1 Position of the test piece for the bending strength test



The size of the test piece shall be $W2 \ 0.1 \times t1.5 \ 0.1 \times \varnothing \ 15(\text{mm})$. Both the upper and lower area or one side surface shall be at a roughness of 0.85 or less. The side surface with the roughness of 0.85 or less, shall be used as the tensile surface, and the surface of C0.1-C0.3 shall be severed.

(2) Equipment and tools

Shall conform to JIS R 1601 (Testing method for flexural strength of high performance ceramics)

(3) Testing method

The bending strength of 3 points, at room temperature and 800C, shall be measured according to the methods described below.

(a) Measurement of test piece breadth and thickness

Before the test, the thickness and breadth of the test piece center shall be marked, up to 0.01mm.

(b) Distance between supporting points and distance between weight points

The distance between the supporting points and the distance between the weight points shall be measured by vernier calipers.