DESCRIPTION

NAME OF INVENTION: CERAMIC, PROBE GUIDING MEMBER, PROBE CARD, AND SOCKET FOR PACKAGE INSPECTION

TECHNICAL FIELD

[0001]

The present invention relates to a ceramic, a probe guiding member, a probe card, and a socket for package inspection.

BACKGROUND ART

[0002]

In a process of manufacturing precision instruments such as electronic components, a low electrostatic-property material for which antistatic measures are enforced is used so as to restrain damage to a product, occurrence of a defect in a product, and the like due to electrostatic discharge, and so as to prevent particles that are floating in an environment from being electrostatically attracted.

[0003]

A probe card is used in, for example, an inspection process on IC chips. Figure 1 illustrates a cross-sectional view illustrating a configuration of a probe card as an example, and Figure 2 is a top view illustrating a configuration of a probe guide as an example. As illustrated in Figure 1, a probe card 10 is an inspection jig that includes needle-shaped probes 11 and a probe guide (probe guiding member) 12 including through holes 12a for allowing the probes 11 to be inserted therethrough. By bringing the probes 11 into contact with IC chips 14 that are formed on a silicon wafer 13, an inspection of the IC chips 14 is conducted. At that time, the probe guide 12 is made of a low electrostatic-property material for which the antistatic measures are enforced.

[0004]

As examples of normal low electrostatic-property materials, materials having

volume resistivities of the order of 10^6 to 10^{12} Ω·cm are widely used, such as resins to which conductive fillers are added (Patent Documents 1 and 2, etc.), and ceramic sintered bodies made by dispersing and sintering conductive ceramics (Patent Documents 3 to 5, etc.).

LIST OF PRIOR ART DOCUMENTS

PATENT DOCUMENT

[0005]

Patent Document 1: JP2005-226031A

Patent Document 2: WO 2002/082592

Patent Document 3: JP2013-136503A

Patent Document 4: JP2008-094688A

Patent Document 5: JP2006-199586A

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0006]

As devices move toward finer design rules and higher performance in recent years, an antistatic-measures material used for an apparatus for manufacturing the devices is required not only to have low electrostatic properties but also to be improved in various properties such as free-machining properties, heat-resistant properties, mechanical properties, a thermal expansivity.

[0007]

For example, an inspection efficiency of an inspection process on IC chips depends on how many probes can be brought into contact with IC chips at the same time. Hence, recent years have been seeing a practical application of a probe card on which tens of thousands of minute probes are set upright with high density by the micro-electromechanical systems (MEMS). As illustrated in Figure 2 given above, the probe guide 12 needs to be provided with the through holes 12a at positions corresponding to the probes 11 of the probe card 10. Setting positions, a shape, and

the like of the probes 11 of the probe card 10 vary according to specifications of the inspection apparatus, and setting positions, a shape, and the like of the through holes 12a vary accordingly. For example, in a case where the probes 11 have a pin shape, a circular hole is adapted for the through holes 12a. An inner diameter of the holes and a pitch of the holes depend on a kind or an arrangement of the probes 11; for example, there is a case where through holes having a diameter of 50 μm are arranged with a 60 μm pitch (a wall thickness between the through holes is about 10 μm). It is necessary to provide tens of thousands of such small through holes, which requires the free-machining properties.

[0008]

A probe guide is required to be excellent in heat-resistant properties so that inspections are conducted in various temperature environments. The probe guide is also required to have a thermal expansivity as high as that of a silicon wafer. The probe guide is also required to be excellent in mechanical properties so that the probe guide can withstand contact and the like in an inspection. The above description is made mainly about the probe guide, and applications of which excellent low electrostatic properties and free-machining properties are required include a socket for inspection such as a socket for package inspection.

[0009]

Here, in a case of the resins described in Patent Documents 1 and 2, to which conductive fillers are added, their rigidities and heat-resistant properties (operating temperatures) are low, and thus in a case where the resins are used for inspection jigs, a number of probes (withstand load) and an inspection temperature range are limited. In addition, such resins have low thermal conductivities and high thermal expansivities, and thus their raw workpieces expand due to heat during the machining, and a desired dimensional precision cannot be obtained in some cases after the machining.

[0010]

In contrast, in a case of the ceramic including Al_2O_3 as its main phase (Patent Document 3) and the ceramics including ZrO_2 as their main phases (Patent Documents 4 and 5), although they are excellent in low electrostatic properties, their hardnesses are

excessively high, and thus it is difficult to perform micromachining, particularly cutting by machining. For that reason, in a case where, for example, these materials are used to fabricate a probe guide, there is a problem in that its production time is extremely lengthened.

[0011]

The present invention has an objective to provide a ceramic that is excellent in low electrostatic properties (10^6 to 10^{14} Ω·cm in volume resistivity) and free-machining properties, and to provide a probe guiding member, a probe card, and a socket for inspection that are made of the ceramic.

SOLUTION TO PROBLEM

[0012]

To achieve the objective described above, the present inventors conducted intensive studies and consequently obtained the following findings.

(a) First, the present inventors investigated a main phase for improving free-machining properties of a ceramic sintered body and found that a ceramic containing Al_2O_3 as its main phase and a ceramic containing ZrO_2 as its main phase each have a hardness so high that it is difficult to perform micromachining, while a ceramic sintered body containing BN as its main phase has an excellent free-machining properties. Therefore, the main phase of the ceramic is preferably BN.

(b) However, BN has a volume resistivity of the order of 10^{15} Ω·cm, which is excessively high, and thus if the ceramic is used continuously in an inspection process, electric charges are accumulated. The accumulated electric charges cannot be discharged gradually, and thus bring about electrostatic discharge. As a result, there is a problem in that current flows through an object being inspected instantaneously, and the object being inspected can be broken in some cases. Hence, in order to adjust the volume resistivity of the ceramic sintered body such that the volume resistivity falls within a range from 10^6 to 10^{14} Ω·cm to give low electrostatic properties, dispersing grains being of the order of 10^3 Ω·cm or less in a base material of the ceramic sintered body is effective. Notable examples of the grains to be dispersed include SiC, WC, C,

TiN, TiO_2, and the like. However, as a simple substance, WC, C, TiN, and TiO_2 are each lower in volume resistivity than SiC. Therefore, it is preferable to disperse a proper amount of SiC in a ceramic containing BN as its main phase.

(c) Only dispersing the proper amount of SiC in the ceramic containing BN as its main phase may result in poor mechanical properties, and thus dispersing ZrO_2 and/or Si_3N_4 together with SiC is effective.

(d) For establishing compatibility between free-machining properties and mechanical properties, a close-grained ceramic sintered body is desirable. To this end, the ceramic is preferably fabricated by a hot pressing calcination method, in which the calcination is performed in a pressurized atmosphere.

[0013]

The present invention is made based on the above findings, and the gist of the present invention is as follows.

[0014]

(1) A ceramic including, in mass %:

BN: 20.0 to 55.0%;

SiC: 5.0 to 40.0%; and

ZrO_2 and/or Si_3N_4: 3.0 to 60.0%.

[0015]

(2) The ceramic according to the above (1), wherein the ceramic has a coefficient of thermal expansion at -50 to 500°C of 1.0×10^{-6} to 5.0×10^{-6} /°C.

[0016]

(3) The ceramic according to the above (1) or (2), wherein the ceramic has a volume resistivity of 10^6 to 10^{14} Ω·cm.

[0017]

(4) The ceramic according to any one of the above (1) to (3), wherein the ceramic has a coefficient of water absorption of 0.5% or less.

[0018]

(5) A probe guiding member that guides probes of a probe card, the probe guiding member including:

a plate-shaped main body that is made of the ceramic according to any one of the above (1) to (4); and

the main body includes a plurality of through holes and/or slits through which the probes are to be inserted.

[0019]

(6) A probe card including:

a plurality of probes; and

the probe guiding member according to the above (5).

[0020]

(7) A socket for package inspection, wherein the socket for package inspection is made of the ceramic according to any one of the above (1) to (4).

ADVANTAGEOUS EFFECTS OF INVENTION

[0021]

The present invention makes it possible to obtain a ceramic that is excellent in low electrostatic properties (10^6 to 10^{14} Ω·cm in volume resistivity) and free-machining properties, which is thus useful particularly to a probe guiding member, a probe card, and a socket for inspection.

BRIEF DESCRIPTION OF DRAWINGS

[0022]

[Figure 1] Figure 1 is a cross-sectional view illustrating a configuration of a probe card as an example.

[Figure 2] Figure 2 is a top view illustrating a configuration of a probe guide as an example.

[Figure 3] Figure 3 is a picture of Example 1 after a micromachining test.

[Figure 4] Figure 4 is a picture of Comparative example 6 after the micromachining test.

DESCRIPTION OF EMBODIMENTS

[0023]

1. Ceramic

A ceramic according to the present invention includes, in mass %, BN: 20.0 to 55.0%, SiC: 5.0 to 40.0%, ZrO_2 and/or Si_3N_4: 3.0 to 60.0%. In the following description, the symbol "%" for contents means "percent by mass."

[0024]

BN: 20.0 to 55.0%

The ceramic according to the present invention is required to be a free-machining material that allows machining to be performed with a cemented carbide tool, and thus in order to give excellent free-machining properties to the ceramic, 20.0% or more of BN is contained as an essential component. However, if a content of BN is more than 55.0%, a material strength is decreased, arising a problem in machining through holes in that walls between through holes are collapsed. Accordingly, the content of BN is to range from 20.0 to 55.0%. A lower limit of the content of BN is preferably 25.0%, and more preferably 30.0%. An upper limit of the content of BN is preferably 50.0%, and more preferably 45.0%.

[0025]

Note that types of BN include hexagonal BN (h-BN) and cubic BN (c-BN), but the c-BN has a high hardness, and it is thus preferable to use h-BN. Although no specific limitation is imposed on a grain diameter of BN, if BN has an excessively large grain diameter, a decrease in material strength may occur, and thus BN preferably has an average grain diameter of less than 5 μm.

[0026]

SiC: 5.0 to 40.0%

SiC is an essential component to adjust a volume resistivity of the ceramic such that the volume resistivity falls within a range from 10^6 to 10^{14} Ω·cm. Accordingly, a content of SiC is to be 5.0% or more. However, if the content of SiC is more than 40.0%, the volume resistivity falls below 10^6 Ω·cm, which not only is an undesirable volume resistivity for the low electrostatic-property material but also raises a problem in that a material hardness increases excessively to impair the free-machining properties. Accordingly, the content of SiC is to range from 5.0 to 40.0%. A lower limit of the

content of SiC is preferably 10.0%, and more preferably 15.0%. An upper limit of the content of SiC is preferably 35.0%, and more preferably 30.0%.

[0027]

Although no specific limitation is imposed on a grain diameter of SiC, if SiC has an excessively large grain diameter, variations in the volume resistivity become large, and thus SiC preferably has an average grain diameter of less than 2.0 μm. In addition, SiC is preferably present being dispersed in the ceramic mainly containing BN. A state of the dispersion can be checked by performing elementary analysis of Si using the energy dispersive X-ray spectrometry (EDX).

[0028]

ZrO_2 and/or Si_3N_4: 3.0 to 60.0%.

ZrO_2 and Si_3N_4 are both components essential for enhancement in the mechanical properties of the ceramic. Accordingly, a content of ZrO_2 and/or Si_3N_4 is to be 3.0% or more. However, if the content of ZrO_2 and/or Si_3N_4 is more than 60.0%, the hardness increases excessively, and the free-machining properties deteriorate, which makes it impossible to form fine holes with high precision. Accordingly, the content of ZrO_2 and/or Si_3N_4 is to range from 3.0 to 60.0%. A lower limit of the content of ZrO_2 and/or Si_3N_4 is preferably 5.0%, and more preferably 10.0%. An upper limit of the content of ZrO_2 and/or Si_3N_4 is preferably 55.0%, and more preferably 50.0%. In a case where ZrO_2 and Si_3N_4 are both contained, their total content is to range from 3.0 to 60.0%.

[0029]

Although no specific limitation is imposed on a grain diameter of ZrO_2 and/or Si_3N_4, if ZrO_2 and/or Si_3N_4 has an excessively large grain diameter, variations in the mechanical properties become large, and thus ZrO_2 and/or Si_3N_4 preferably has an average grain diameter of less than 2 μm. In addition, ZrO_2 and/or Si_3N_4 is preferably present being dispersed in the ceramic mainly containing BN. A state of the dispersion can be checked by the elementary analysis using EDX.

[0030]

The ceramic according to the present invention contains, in addition to the

components described above, a sintering agent necessary to obtain a close-grained ceramic. As the sintering agent, one or more kinds selected from, for example, aluminum oxide (alumina, Al_2O_3), magnesium oxide (magnesia, MgO), yttrium oxide (yttria, Y_2O_3), oxides of lanthanoid metals, and complex oxides such as spinel, can be used. Of these, a mixture of alumina and yttria, or a mixture of alumina and yttria further containing magnesia is preferable.

[0031]

No specific limitation is imposed on a content of the sintering agent, but the content is desirably 1.0 to 15.0%. If the compounding amount is excessively small, the sintering becomes insufficient, decreasing the strength of the ceramic as a sintered body. In contrast, if the compounding amount is excessively large, grain boundary phases made of glass and crystals having low strengths increase, which also incurs a decrease in the strength of the ceramic. Furthermore, because the grain boundary phases have high volume resistivities, the excessively large compounding amount incurs an increase in the volume resistivity of the ceramic, adversely affecting the low electrostatic properties. The content of the sintering agent is preferably 3.0% or more, and more preferably 5.0% or more. The content of the sintering agent is preferably 12.0% or less, and more preferably 10.0% or less.

[0032]

Contents of the respective components (mass %) can be measured by the ICP emission spectral analysis.

[0033]

Coefficient of Thermal Expansion at -50 to 500°C: 1.0×10^{-6} to 5.0×10^{-6} /°C

In a case where the ceramic according to the present invention is used for a probe guide, the ceramic is required to have a coefficient of thermal expansion as high as that of a silicon wafer on which IC chips are formed. This is because, when a temperature in the inspection changes, positions of the IC chips move with thermal expansion of the silicon wafer. At the time, in a case where the probe guide has a coefficient of thermal expansion as high as that of the silicon wafer, the probe guide moves in synchronization with expansion and contraction of the silicon wafer, which

enables a high precision inspection to be kept. This also applies to a case where the ceramic according to the present invention is used for a socket for inspection. Accordingly, a reference coefficient of thermal expansion at -50 to 500°C is 1.0×10^{-6} to 5.0×10^{-6} /°C.

[0034]

Volume Resistivity: 10^{6} to 10^{14} Ω·cm

A feature of the ceramic according to the present invention is having low electrostatic properties, and its reference volume resistivity is 10^{6} to 10^{14} Ω·cm.

[0035]

Coefficient of Water Absorption: 0.5% or less

The ceramic according to the present invention is required to be close-grained so that necessary mechanical properties are obtained. Sufficient mechanical properties may not be obtained if there are a large number of residual pores, and thus a reference coefficient of water absorption is 0.5% or less.

[0036]

Flexural Strength: 200 MPa or more

In a case where the ceramic according to the present invention is used for a probe guide, the ceramic is required to have mechanical properties sufficient to withstand contact and a load of probes and the like in the inspection. This also applies to a case where the ceramic according to the present invention is used for a socket for inspection. Accordingly, a reference flexural strength is 200 MPa or more.

[0037]

Free-Machining Properties

Regarding free-machining properties, a machining precision of performing cutting working using a cemented carbide micro drill to form 1000 (8 × 125 rows) through holes having diameters of 50 μm and 100 μm with a 60 μm pitch is evaluated by observing the through holes by a vision measuring system (e.g., Quick Vision from Mitutoyo Corporation). At that time, a case where the machining precision is within ± 3.0 μm is determined to be good in the free-machining properties.

[0038]

2. Method for Producing Ceramic

An example of a method for producing the ceramic according to the present invention will be described below.

[0039]

Powders of BN, SiC, and ZrO_2 and/or Si_3N_4 are mixed together with the sintering agent by a known method such as a method using a ball mill. That is, the powders, solvent, resin-made balls each including a ceramic-made or iron-made core therein are mixed in a container to be formed into slurry. At that time, as the solvent, water or alcohol can be used. In addition, an additive such as a dispersant and a binder may be used as necessary.

[0040]

The obtained slurry is formed into grains by a known method such as spray drying and a method using a decompression evaporator. That is, the slurry is spray-dried by a spray dryer to be formed into granules or is dried by the decompression evaporator to be formed into powder.

[0041]

The obtained powder is sintered under a high temperature and a high pressure by, for example, a known method such as hot pressing and hot isostatic pressing (HIP) to be formed into a sintered ceramic body. In the case of the hot pressing, the powder may be calcined in a nitrogen atmosphere or in pressurized nitrogen. In addition, a temperature of the calcination preferably ranges from 1400 to 1900°C. If the temperature is excessively low, the sintering becomes insufficient, and if the temperature is excessively high, a problem such as liquating oxide components arises.

[0042]

An appropriate pressing force ranges from 15 to 50 MPa. In addition, a duration of maintaining the pressing force is normally about 1 to 4 hours, which however depends on the temperature or the dimensions. Also in a case of the HIP, calcination conditions including the temperature and the pressing force are to be set as appropriate. Alternatively, a known calcination method such as a pressureless calcination method and an atmosphere pressing calcination may be adopted.

EXAMPLE

[0043]

In order to confirm the effects of the present invention, powders of BN (h-BN), SiC, and ZrO_2 and/or Si_3N_4 were mixed together with the sintering agent (the mixture of alumina and yttria, or the mixture of alumina and yttria further containing magnesia) at various compounding ratios with water, dispersant, resin, and ceramic-made balls, and obtained slurries were each spray-dried by a spray dryer to be formed into granules. The obtained granules were charged into a graphite-made dice (mold) and subjected to hot pressing calcination in a nitrogen atmosphere, under a pressure of 30 MPa, at 1700°C, for 2 hours, to be formed into test materials being 150 mm long × 150 mm wide × 30 mm thick.

[0044]

For reference, a resin to which commercial carbon fiber was added (Comparative example 8), a ceramic including commercial Al_2O_3 as its main phase (Comparative example 9), a ceramic including commercial ZrO_2 as its main phase (Comparative example 10) were prepared as test materials.

[0045]

From the obtained test materials, test specimens were taken and subjected to various kinds of tests.

[0046]

<Volume Resistivity>

A volume resistivity of each of the test materials was determined in conformity with JIS C2141.

[0047]

<Thermal Expansivity>

A coefficient of thermal expansion of each of the test materials at -50 to 500°C was determined in conformity with JIS R1618.

[0048]

<Coefficient of Water Absorption>

A coefficient of water absorption of each of the test materials was determined in conformity with JIS C2141.

[0049]

<Flexural Strength>

A three-point flexural strength of each of the test materials was determined in conformity with JIS R1601.

[0050]

<Free-Machining Properties>

Regarding free-machining properties, a machining precision of performing cutting working using a cemented carbide micro drill to form 1000 (8 × 125 rows) through holes having diameters of 50 μm and 100 μm with a 60 μm pitch was evaluated by performing visual observation on the through holes (a case where the machining precision was within ±3.0 μm was determined to be good). At that time, a case where the machining precision was within ±3.0 μm was determined to be good in the free-machining properties and marked as "○," a case where the machining precision out of ±3.0 μm was marked as "△," and a case where the drilling failed due to a breakage of the drill or the like was marked as "×," which were written in Table 1.

[0051]

[Table 1]

Table 1

Category		Content (mass%)									Volume resistivity	Coefficient of water absorption	Flexural strength	Thermal expansivity	Fine hole machining test	
		SiC	C	TiO_2	BN	ZrO_2	Si_3N_4	Y_2O_3	Al_2O_3	MgO	(Ωcm)	(%)	(MPa)	($\times10^{-6}$/℃)	φ50um	φ100um
Example	1	8.5	-	-	36.0	48.0	-	5.6	1.9	-	9.1×10^{13}	0.0	318	4.6	○	○
	2	18.5	-	-	39.2	34.8	-	5.6	1.9	-	5.3×10^{13}	0.0	326	3.2	○	○
	3	21.3	-	-	40.0	31.2	-	5.6	1.9	-	3.9×10^{12}	0.0	335	3.2	○	○
	4	24.2	-	-	41.0	27.3	-	5.6	1.9	-	1.3×10^{11}	0.0	329	2.8	○	○
	5	10.9	-	-	38.4	-	43.2	5.6	1.9	-	1.2×10^{13}	0.0	555	1.1	○	○
	6	14.1	-	-	38.4	-	40.0	5.6	1.9	-	1.2×10^{13}	0.0	549	1.2	○	○
	7	15.2	-	-	38.4	-	38.9	5.6	1.9	-	5.9×10^{11}	0.0	512	1.0	○	○
	8	16.3	-	-	38.4	-	37.8	5.6	1.9	-	4.2×10^{10}	0.0	503	1.1	○	○
	9	17.4	-	-	38.4	-	36.7	5.6	1.9	-	8.0×10^{9}	0.0	532	1.3	○	○
	10	19.1	-	-	37.4	-	33.6	7.2	2.7	-	9.1×10^{8}	0.0	510	1.2	○	○
	11	21.2	-	-	37.4	-	31.5	7.2	2.7	-	1.1×10^{8}	0.0	519	1.3	○	○
	12	10.4	-	-	25.5	-	56.6	5.6	1.9	-	4.6×10^{12}	0.0	611	1.6	○	○
	13	22.3	-	-	51.2	-	16.6	5.4	2.7	1.8	6.8×10^{10}	0.0	230	1.3	○	○
	14	36.2	-	-	25.5	25.5	4.5	5.5	1.8	1.0	4.3×10^{6}	0.0	469	3.6	○	○
	15	15.0	-	-	38.8	18.8	19.9	5.6	1.9	-	8.5×10^{11}	0.0	473	2.9	○	○
	16	24.2	-	-	41.0	27.3	-	5.6	1.9	-	3.4×10^{11}	0.8	253	2.7	○	○
Comparative example	1	-*	-	-	32.6	47.4	12.5	5.6	1.9	-	1.9×10^{15}#	0.0	344	4.7	○	○
	2	-*	-	-	47.7	-	44.8	5.6	1.9	-	2.0×10^{15}#	0.0	447	1.4	○	○
	3	2.3*	-	-	34.1	56.1	-	5.6	1.9	-	7.7×10^{14}#	0.0	322	4.8	○	○
	4	43.8*	-	-	12.4*	16.5	17.4	6.3	1.8	1.8	1.6×10^{5}#	0.0	656	3.4	× Drill broken	△ Precision ≥± 3um
	5	-*	3.8	-	39.2	-	49.5	5.6	1.9	-	9.5×10^{15}#	0.0	269	1.3	○	○
	6	-*	7.8	-	39.9	-	44.8	5.6	1.9	-	8.0×10^{6}	0.0	138#	1.3	△ Wall broken	△ Wall broken
	7	-*	-	23.1	-	-	69.4*	3.7	1.9	1.9	1.2×10^{15}#	0.0	741	2.8	× Drill broken	× Drill broken
	8	Antistatic-measures peek (resin)									1.2×10^{9}	0.1	142#	40.0#	△ Wall broken, Precision ≥± 3um	△ Wall broken, Precision ≥± 3um
	9	Antistatic-measures Al_2O_3									5.6×10^{10}	0.0	475	7.4#	× Drill broken	× Drill broken
	10	Antistatic-measures ZrO_2									9.8×10^{8}	0.0	865	8.6#	× Drill broken	× Drill broken

The mark "*" indicates that its value fell out of the range specified in the present invention.
The mark "#" indicates that its property did not satisfy the range desired in the present invention.

[0052]

Figure 3 is a picture of Example 1 after a refining test, and Figure 4 is a picture of Comparative example 6 after the refining test.

[0053]

As shown in Table 1, Comparative examples 1 to 3 were examples in which BN was contained as their main phases, ZrO_2 and/or Si_3N_4 were contained, but their contents of SiC were low, or they did not contain SiC, and thus their volume resistivities became excessively high. In Comparative example 4, its content of BN was excessively low, and its content of hard SiC was excessively high, and thus its free-machining properties deteriorated in a micromachining test. Comparative examples 5 and 6 were examples in which C was contained rather than SiC; in Comparative example 5, its volume resistivity was excessively high, and in

Comparative example 6, its free-machining properties deteriorated. Comparative example 7 was an example in which Si_3N_4 was contained as its main phase, and TiO_2 was contained, but its volume resistivity was excessively high, and in addition, its free-machining properties deteriorated. In Comparative examples 8 to 10, all of their free-machining properties deteriorated.

[0054]

In contrast, Examples 1 to 16 were good in both the volume resistivity and the free-machining properties. Example 16 satisfied the required qualities, but its coefficient of water absorption was as high as 0.8, and its flexural strength deteriorated to some degree. In addition, in Comparative example 6, a collapse of walls between the through holes occurred in the cutting working, but in Example 1, the through holes were successfully formed with high precision without the occurrence of such collapse, as illustrated in Figure 3 and Figure 4.

INDUSTRIAL APPLICABILITY

[0055]

The present invention makes it possible to obtain a ceramic that is excellent in low electrostatic properties (10^6 to 10^{14} Ω·cm in volume resistivity) and free-machining properties, which is thus useful particularly to a probe guiding member, a probe card, and a socket for inspection.

CLAIMS

[Claim 1]

A ceramic comprising, in mass %:

BN: 20.0 to 55.0%;

SiC: 5.0 to 40.0%; and

ZrO_2 and/or Si_3N_4: 3.0 to 60.0%.

[Claim 2]

The ceramic according to claim 1, wherein the ceramic has a coefficient of thermal expansion at -50 to 500°C of 1.0×10^{-6} to 5.0×10^{-6} /°C.

[Claim 3]

The ceramic according to claim 1 or 2, wherein the ceramic has a volume resistivity of 10^6 to 10^{14} Ω·cm.

[Claim 4]

The ceramic according to any one of claims 1 to 3, wherein the ceramic has a coefficient of water absorption of 0.5% or less.

[Claim 5]

A probe guiding member that guides probes of a probe card, the probe guiding member comprising:

a plate-shaped main body that is made of the ceramic according to any one of claims 1 to 4; and

the main body includes a plurality of through holes and/or slits through which the probes are to be inserted.

[Claim 6]

A probe card comprising:

a plurality of probes; and

the probe guiding member according to claim 5.

[Claim 7]

A socket for package inspection, wherein the socket for package inspection is

made of the ceramic according to any one of claims 1 to 4.