

DESCRIPTION

Title of Invention

HOLLOW SEALING STRUCTURE

5 Technical Field

[0001] The present invention relates to a hollow sealing structure.

Background Art

10 [0002] In recent years, as a structure in which, while the movable property of a movable part of a small electronic component such as a surface acoustic wave (SAW) filter is secured, the electronic component is sealed on a substrate by a sealing material, a hollow sealing structure having a hollow structure has been studied (for example, Patent Literature 1).

Citation List

15 Patent Literature

[0003] Patent Literature 1: Japanese Unexamined Patent Publication No. 2016-175976

Summary of Invention

Technical Problem

20 [0004] However, in an electronic component device having a hollow structure, as compared with a sealing structure having no hollow structure, an adhesive strength between a substrate and a sealing material may be lowered and durability as a hollow sealing structure may be degraded.

25 [0005] The present invention has been made in view of the circumstance described above, and an object thereof is to provide a

hollow sealing structure with improved durability.

Solution to Problem

[0006] In order to achieve the above-described object, a hollow sealing structure according to an embodiment of the present invention has a substrate, an electronic component that is disposed on a projecting part provided on the substrate, the electronic component being separated from the substrate, and a sealing part formed from an insulating material, the sealing part sealing the electronic component in a state in which a hollow region is formed between the electronic component and the substrate, in which in the entire periphery of the outer periphery of the electronic component in plan view, the sealing part enters from the outer periphery between the electronic component and the substrate.

[0007] According to the above-described hollow sealing structure, in the entire periphery of the outer periphery of the electronic component, the sealing part enters between the electronic component and the substrate. Thus, the sealing part entering between the electronic component and the substrate makes improvements in adhesiveness between the electronic component and the substrate and durability as the hollow sealing structure.

[0008] Herein, the sealing part entering between the electronic component and the substrate may be separated from the projecting part.

[0009] As described above, by the sealing part being provided to be separated from the projecting part, it is possible to prevent that the sealing part is dispersed at the time of manufacturing or the like and thus the hollow region cannot be appropriately secured.

[0010] Further, a ratio of an area of the sealing part entering between

the electronic component and the substrate in plan view may be 1% to 30% with respect to an area of the electronic component in plan view.

[0011] With the above-described configuration, the hollow region can be appropriately secured while an effect of improving the adhesiveness between the electronic component and the substrate by the sealing part is suitably exhibited, and degradation in reliability of the electronic component can be prevented.

Advantageous Effects of Invention

[0012] According to the present invention, a hollow sealing structure with improved durability is provided.

Brief Description of Drawings

[0013] FIG. 1 is a schematic cross-sectional view of a hollow sealing structure according to an embodiment of the present invention.

FIG. 2 is a plan view of the hollow sealing structure and schematically illustrates the distribution of a sealing material.

FIG. 3 is a view describing a method for manufacturing the hollow sealing structure.

Description of Embodiments

[0014] Hereinafter, a mode for carrying out the present invention will be described in detail with reference to the attached drawings. Incidentally, in the description of the drawings, the same reference signs are given to the same elements, and duplicate description will be omitted.

[0015] FIG. 1 is a schematic cross-sectional view illustrating a hollow sealing structure 1 according to an embodiment of the present invention. Further, FIG. 2 is a plan view of the hollow sealing structure 1 and

schematically illustrates the distribution of a sealing material.

As illustrated in FIG. 1, the hollow sealing structure 1 has a substrate 10, an electronic component 20 mounted above the substrate 10, and a sealing part 30 sealing the electronic component 20. The hollow sealing structure 1 is a structure having the electronic component 20 sealed thereinside, and is applied, for example, to communication devices and the like.

[0016] The substrate 10 is a wiring substrate having conductor wiring formed with respect to a plate-shaped insulator. For example, a silicon (Si) substrate, a glass substrate, a sapphire substrate, or the like can be used. The substrate 10 may have a wiring layer and may be, for example, a multi-layer wiring substrate.

[0017] The electronic component 20 is flip-chip mounted above the substrate 10 and electrically connected to wiring formed in the substrate 10. The type of the electronic component 20 used in the hollow sealing structure 1 is not particularly limited, and examples thereof include a surface acoustic wave (SAW) filter, micro electro mechanical systems (MEMS) such as a sensor, a semiconductor element, and a capacitor. Here, in the case of the electronic component 20 being a device having a movable part, the hollow sealing structure 1 is suitably used. Examples of such an electronic component 20 include a SAW filter and micro electro mechanical systems (MEMS). In this embodiment, the case of the electronic component 20 being a SAW filter will be described. In the case of the electronic component 20 being a SAW filter, the electronic component 20 has a piezoelectric substrate 21 and inter digital transducers (IDTs) 22 that are a pair of

comb-shaped electrodes disposed on the surface of the piezoelectric substrate 21.

[0018] The electronic component 20 is flip-chip mounted with respect to the substrate 10 through Au bumps 25, which are conductor projecting parts provided on the substrate 10, such that the surface of the piezoelectric substrate 21 to which the IDTs 22 are attached faces downward (faces the surface of the substrate 10). Accordingly, the electronic component 20 is maintained above the substrate 10 in a state of being separated from the substrate 10. Incidentally, instead of the Au bump 25, a solder bump or the like can also be used. In order to electrically connect the electronic component 20 and the substrate 10, a bump of a conductor material is used, but regarding parts in which electrical connection is not necessary, for example, a projecting part formed by an insulating material or the like may be used. In the hollow sealing structure 1 of this embodiment, the electronic component 20 is supported by four Au bumps 25 (see FIG. 2) to be separated from the substrate 10.

[0019] The sealing part 30 is provided so as to seal the electronic component 20 while covering the entire upper surface of the substrate 10. The sealing part 30 is provided such that the sealing part 30 is in contact with the electronic component 20 at the upper surface of the electronic component 20 (the surface at the side opposite to the lower surface facing the substrate 10: the surface facing the surface on which the IDTs 22 are disposed) and at the lateral surfaces of the electronic component 20 and the lower surface side of the electronic component 20 becomes hollow. As a result, a hollow region H is formed between

the electronic component 20 and the substrate 10 by the sealing part 30. In the electronic component 20, the pair of IDTs 22 and the surface of the piezoelectric substrate 21 therebetween are exposed, so that the electronic component 20 functions as a SAW filter. Therefore, the hollow region H is provided such that the pair of IDTs 22 and the surface of the piezoelectric substrate 21 therebetween of the electronic component 20 are exposed.

[0020] The sealing part 30 may be configured from an insulating material, and a material thereof is not particularly limited. Here, the sealing part 30 is required to maintain the shape in a state of securing the hollow region H between the electronic component 20 and the substrate 10.

[0021] The size of the above-described hollow sealing structure 1 is appropriately selected on the basis of the size of the electronic component 20, or the like. For example, in the case of using a square electronic component having a side of about 0.5 mm to 3 mm in plan view as the electronic component 20, the substrate 10 larger than the electronic component 20 is used. In addition, the thickness of the sealing part 30 (the height from the surface of the substrate 10 to the uppermost surface of the sealing part 30) is set to be thicker than that of the electronic component 20 flip-chip mounted above the substrate 10, but is set, for example, to about 20 μm to 250 μm .

[0022] A resin composition suitably used as the sealing part 30 will be described, but is not limited to the following materials. The resin composition used in the sealing part 30 can contain, for example, a thermosetting resin (A) and an inorganic filler (B).

[0023] As the above-described component (A), an epoxy resin or a phenolic resin can be used. As the epoxy resin used as the above-described component (A), any epoxy resin can be used without particular limitation as long as it has two or more glycidyl groups in one molecule. One kind thereof may be used singly or two or more kinds thereof may be used in combination. Examples thereof include a bisphenol A type epoxy resin, a bisphenol AP type epoxy resin, a bisphenol AF type epoxy resin, a bisphenol B type epoxy resin, a bisphenol BP type epoxy resin, a bisphenol C type epoxy resin, a bisphenol E type epoxy resin, a bisphenol F type epoxy resin, a bisphenol G type epoxy resin, a bisphenol M type epoxy resin, a bisphenol S type epoxy resin, a bisphenol P type epoxy resin, a bisphenol PH type epoxy resin, a bisphenol TMC type epoxy resin, a bisphenol Z type epoxy resin, a bisphenol S type epoxy resin such as hexanediol bisphenol S diglycidyl ether, a novolac phenol type epoxy resin, a biphenyl type epoxy resin, a naphthalene type epoxy resin, a dicyclopentadiene type epoxy resin, a bixylenol type epoxy resin such as bixylenol diglycidyl ether, a hydrogenated bisphenol A type epoxy resin such as hydrogenated bisphenol A glycidyl ether, dibasic acid-modified diglycidyl ether type epoxy resin thereof, and an aliphatic epoxy resin.

[0024] Further, as the phenolic resin used as the above-described component (A), any known phenolic resin can be used without particular limitation as long as it has two or more phenolic hydroxyl groups in one molecule. Examples thereof include resins obtained by condensing or co-condensing phenols such as phenol, cresol, xylenol,

resorcinol, catechol, bisphenol A, and bisphenol F or naphthols such as α -naphthol, β -naphthol, and dihydroxynaphthalene with aldehydes such as formaldehyde, acetaldehyde, propionaldehyde, benzaldehyde, and salicylaldehyde in the presence of an acidic catalyst, a biphenyl skeleton
5 type phenolic resin, a paraxylylene-modified phenolic resin, a metaxylylene-paraxylylene-modified phenolic resin, a melamine-modified phenolic resin, a terpene-modified phenolic resin, a dicyclopentadiene-modified phenolic resin, a cyclopentadiene-modified phenolic resin, a polycyclic aromatic ring-modified phenolic resin, and
10 a xylylene-modified naphthol resin.

[0025] Incidentally, a curing accelerator may be contained in the thermosetting resin that is the component (A). The type of the curing accelerator is not particularly limited, but an amine-based or phosphorus-based curing accelerator can be selected. In particular,
15 since imidazoles have lots of derivatives and are easy to obtain a desired activating temperature, imidazoles can be selected as a curing accelerator in the thermosetting resin of the component (A).

[0026] The mixing ratio of the epoxy resin and the phenolic resin in the component (A) and the mixing ratio of the curing accelerator to the epoxy resin and/or the phenolic resin can be appropriately set within
20 such a range that the sealing part 30 can appropriately maintain the shape.

[0027] As the component (B) of the resin composition used in the sealing part 30, a conventionally known inorganic filler can be used and
25 is not limited to particular one. Examples thereof include barium sulfate, barium titanate, amorphous silica, crystalline silica, fused silica,

spherical silica, talc, clay, magnesium carbonate, calcium carbonate, aluminum oxide, aluminum hydroxide, silicon nitride, and aluminum nitride. Silica can be selected from the viewpoint of easily improving dispersibility into a resin or easily suppressing settling in varnish by surface modification or the like and the viewpoint of easily obtaining desired cured film properties since silica has a relatively small thermal expansion rate. These inorganic fillers may be subjected to a dispersion treatment in advance as necessary. Examples of means for the dispersion treatment include a nanomizer or performing dispersion by a high-speed shear force and a bead mill of pulverizing an inorganic filler using spherical media called beads.

[0028] Further, the above-described inorganic filler may be surface-modified. Means for the surface modification is not particularly limited, but in the case of using a silane coupling agent, the surface modification is simple, there are a variety of types of functional groups, and desired properties are easily provided. As the silane coupling agent, for example, alkylsilane, alkoxysilane, vinylsilane, epoxysilane, aminosilane, acrylsilane, methacrylsilane, mercaptosilane, sulfide silane, isocyanatosilane, sulfur silane, styrylsilane, alkylchlorosilane, and the like are usable.

[0029] The amount of the inorganic filler of the component (B) added can be appropriately set within such a range that the shape of the sealing part 30 can be properly maintained.

[0030] Furthermore, an elastomer may be contained in the resin composition used in the sealing part 30. The elastomer contained in the resin composition can be used without particular limitation as long

as the carboxyl group equivalent is 340 g/eq. or more and 4,300 g/eq. or less.

[0031] The average molecular weight of the elastomer component can be set to 300,000 or more and can be set to 400,000 or more from the viewpoint of suppressing the resin flowing into a hollow part. Further, the average molecular weight of the elastomer component can be set to 500,000 or more. In addition, when the average molecular weight is too large, flowability is suppressed more than a desire, so that a chip embedding failure may occur. For this reason, the average molecular weight of the elastomer component can be set to 10,000,000 or less. In addition, the average molecular weight of the elastomer component can be set to 5,000,000 or less, and further, can be set to 3,000,000 or less.

[0032] Further, other additives may be further contained in the resin composition used in the above-described sealing part 30 within a range that does not impair the function as the sealing part 30. Specific examples of such additives may include an organic solvent, a pigment, a dye, a mold release agent, an antioxidant, a surface-tension modifier, and an ion-trapping agent.

[0033] Herein, the sealing part 30 in the hollow sealing structure 1 according to this embodiment will be further described with reference to FIG. 1 and FIG. 2.

[0034] The sealing part 30 forms the hollow region H between the lower surface of the electronic component 20 (the surface facing the substrate 10) and the substrate 10 and enters into some of the region between the lower surface of the electronic component 20 and the substrate 10 as well. As a result, as illustrated in FIG. 1, the

piezoelectric substrate 21 is in contact with the sealing part 30 at the outer edge of the lower surface (the mounting surface of the IDTs 22) of the piezoelectric substrate 21 of the electronic component 20.

[0035] FIG. 2 is a plan view of the hollow sealing structure 1 and illustrates the distribution of sealing part 30 on the substrate 10 and at the lower side below the electronic component 20. In FIG. 2, the outer shape of the substrate 10 and the Au bumps 25 are shown by the solid line, and the outer shape of the electronic component 20 is shown by the dashed line. As illustrated in FIG. 2, at the height position between the substrate 10 and the electronic component 20, in the entire periphery of the outer periphery of the electronic component 20, the sealing part 30 enters into the lower side of the electronic component 20. Further, the sealing part 30 entering into the lower side of the electronic component 20 is contact with the lower surface of the electronic component 20 (the lower surface of the piezoelectric substrate 21) and is also contact with the upper surface of the substrate 10 as illustrated in FIG. 1. Therefore, in the region of the outer periphery of the electronic component 20 into which the sealing part 30 enters, the lower surface of the electronic component 20 and the upper surface of the substrate 10 are connected by the sealing part 30. Thus, the adhesiveness between the electronic component 20 and the substrate 10 is improved.

[0036] Further, an end portion 30a of the sealing part 30 at the lower side of the electronic component 20 is not contact with the Au bumps 25 that are projecting parts provided on the substrate 10. That is, the sealing part 30 is separated from the Au bumps 25. The sealing part 30 and the Au bumps 25 may be contact with each other. Here, in a case

where the sealing part 30 in a state of having flowability before curing is contact with the Au bumps 25, the sealing part 30 before curing may reach a constructing unit necessary for exhibiting the function as a SAW filter such as the IDT 22 or the like of the electronic component 20 through the Au bumps 25, the surface of the electronic component 20, or the like. Therefore, an embodiment in which the sealing part 30 is formed to be separated from the Au bumps 25 can be employed.

[0037] The ratio of the area of the sealing part 30 entering into the lower side of the electronic component 20 (that is, the ratio of the area of the sealing part 30 which is provided inside in relation to the electronic component 20 shown by the dashed line in FIG. 2) can be set to 1% to 30% with respect to the area of the electronic component 20 in plan view. With the above-described range, the effect of improving adhesiveness by the sealing part 30 is enhanced. In addition, when the ratio of the area of the sealing part 30 is 5% or more with respect to the area of the electronic component 20 in plan view, the effect of improving adhesiveness by the sealing part 30 entering into the lower side of the electronic component 20 is enhanced. Further, when the ratio of the area of the sealing part 30 is 29% or less with respect to the area of the electronic component 20 in plan view, the sealing part 30 entering into the lower side of the electronic component 20 can be prevented from being contact with a constructing unit necessary for exhibiting the function as a SAW filter such as the IDT 22 or the like of the electronic component 20 and a deterioration in performance of the electronic component 20, or the like can be prevented.

[0038] Next, a method for manufacturing the hollow sealing structure 1

will be described with reference to FIG. 3. First, as illustrated in FIG. 3(A), the electronic component 20 is flip-chip mounted above the substrate 10 by providing the Au bumps 25. Incidentally, in this stage, a plurality of electronic components 20 are mounted above the substrate 10. Meanwhile, a sealing material sheet 40 for forming the sealing part 30 is prepared. The sealing material sheet 40 is one in which a sealing material layer 30A that becomes the sealing part 30 is formed in a layer shape on a film-shaped support 35. As the support 35, a polymer film, a metal foil, or the like can be used. Incidentally, a material contained in the sealing material layer 30A is the same as that of the sealing part 30. The sealing material sheet 40 can be manufactured by preparing varnish in which each material contained in the sealing material layer 30A is dissolved and dispersed by an organic solvent and applying the varnish onto the support 35 by using a die coater or the like and then drying the varnish. A conventionally known organic solvent can be used as the organic solvent. Incidentally, at the time of manufacturing the sealing material sheet 40, a layer for protection may be formed on the sealing material layer 30A. By forming a layer for protection, effects of improving handleability, preventing foreign matters from being mixed, and the like are obtainable. As the layer for protection, for example, a polymer film, a metal foil, or the like can be used. Here, the layer for protection is peeled off at the time of using the sealing material sheet 40.

[0039] Next, as illustrated in FIG. 3(B), in a state in which the surface of the substrate 10 mounted with the electronic component 20 faces the sealing material layer 30A of the sealing material sheet 40, the substrate

10 is brought close to the sealing material sheet 40 and the electronic component 20 is embedded in the sealing material layer 30A to cover the electronic component 20 above the substrate 10. In order to embed the electronic component 20 in the sealing material layer 30A, the sealing material layer 30A is softened or melted by heating, and then pressurization is performed such that the substrate 10 and the support 35 of the sealing material sheet 40 are brought close to each other. As a result, the electronic component 20 is embedded in the sealing material layer 30A. By adjusting a pressurization condition or the like at this time, as illustrated in FIG. 3(B), the hollow region H is formed at the lower side of the electronic component 20 (between the electronic component 20 and the substrate 10) and some of the sealing material layer 30A can be allowed to enter into the lower side of the electronic component 20. As illustrated in FIG. 3(B), after confirming a state in which the electronic component 20 is embedded at a desired position in the sealing material layer 30A and the sealing material layer 30A enters into the lower side of the electronic component 20, the support 35 is peeled off and then heating is performed at a predetermined temperature. By heating, the sealing material layer 30A inside which the electronic component 20 is embedded is cured. As a result, the electronic component 20 is fixed at a desired position in the sealing material layer 30A.

[0040] Thereafter, as illustrated in FIG. 3(C), the substrate 10 is divided to obtain the hollow sealing structures 1 in which the electronic component 20 is sealed inside the sealing part 30.

[0041] As described above, with the hollow sealing structure 1

according to this embodiment, in the entire periphery of the outer periphery of the electronic component 20, the sealing part 30 enters between the lower surface of the electronic component 20 and the upper surface of the substrate 10. Therefore, by the sealing part 30 entering
5 into the lower side of the electronic component 20, the lower surface of the electronic component 20 and the upper surface of the substrate 10 are connected, and thus the adhesiveness between the electronic component 20 and the substrate 10 is improved and durability as the hollow sealing structure is improved.

10 [0042] Further, in the hollow sealing structure 1 according to this embodiment, the sealing part 30 is provided to be separated from the Au bumps 25 that are projecting parts. Therefore, it is possible to prevent that the sealing part 30 is dispersed at the time of manufacturing or the like and thus the hollow region H cannot be appropriately secured.

15 [0043] Further, when the ratio of the area of the sealing part 30 entering into the lower side of the electronic component 20 in plan view is 1% to 30% with respect to the area of the electronic component 20 in plan view, it is possible to appropriately secure the hollow region and prevent a deterioration in reliability of the electronic component, while the
20 effect of improving adhesiveness between the electronic component 20 and the substrate 10 by the sealing part 30 is suitably exhibited.

[0044] Hereinbefore, the embodiment of the present invention has been described, but the present invention is not limited to the above-described embodiment and can be modified in many ways.

25 [0045] For example, in the above-described embodiment, the case of having a structure in which one electronic component 20 is mounted by

four Au bumps 25 provided on the substrate 10 has been described as the hollow sealing structure 1. However, the shape or number of the bumps, the arrangement of the electronic component 20, and the like can be appropriately changed. In addition, the shape or the like of the sealing part 30 can also be appropriately changed.

Examples

[0046] Hereinafter, the present invention will be described in more detail on the basis of Examples and Comparative Examples; however, the present invention is not limited to the following Examples at all.

[0047] <Preparation of Resin Composition Corresponding to Sealing Part>

A resin composition used in the sealing part in the hollow sealing structure of the above-described embodiment was prepared. As components of the resin composition, the following materials were used.

A: Bisphenol F type epoxy resin (trade name "806" manufactured by DIC Corporation, epoxy group equivalent: 160 g/eq, an epoxy resin which exhibits a liquid state at 25°C)

B: Novolac type phenolic resin (trade name "DL-92" manufactured by Meiwa Plastic Industries, Ltd., phenolic hydroxyl group equivalent: 107 g/eq)

C: Imidazole (2P4MZ manufactured by SHIKOKU CHEMICALS CORPORATION)

D: Acrylic acid ester polymer (trade name "SG-280 EK23" manufactured by Nagase ChemteX Corporation, molecular weight 900,000)

E: Silica (trade name "5 μm SX-E2" manufactured by Admatechs Company Limited, phenylamino silane treated, average particle diameter: 5.8 μm)

[0048] <Preparation of Resin Composition>

5 Into a 0.5 L plastic container, 100 g of methyl ethyl ketone (MEK) was put, 72.4 g of A, 48.4 g of B, 12.1 g of D, and 866.7 g of E were put thereinto, and an inorganic filler E1 was dispersed with stirring blades. Thereafter, 0.4 g of C was added as a curing catalyst and was further stirred for 30 minutes. This resultant product was filtered with
10 a #150 mesh made of nylon (opening: 106 μm) and the filtrate was collected, thereby producing a varnish-like resin composition. This varnish-like resin composition was formed into a film-shaped resin composition to have a thickness of the resin composition of 110 μm on a polyethylene terephthalate (PET) film serving as a support by using a
15 coater under the following conditions.

- Coating head scheme: Comma
- Coating and drying speed: 1 m/min
- Drying condition (temperature/furnace length): 80°C/1.5 m, 100°C/1.5 m
- 20 · Film-shaped support: Polyethylene terephthalate having a thickness of 38 μm
- Layer for protection: Polyethylene terephthalate having a thickness of 50 μm

25 [0049] The ratio (% by mass) of each material to the total mass is presented in Table 1.

[0050] [Table 1]

Material	Example·Comparative Example (% by mass)
A (806)	7.24
B (DL92)	4.84
C (2P4MZ)	0.04
D (SG-280 EK23)	1.21
E (5 micron SX-E2)	86.67

[0051] <Preparation of Test Pieces According to Examples 1 to 5 and Comparative Examples 1 and 2>

Test pieces used in the adhesiveness evaluation were prepared by the following method.

5 [0052] First, a double-sided adhesive tape was applied to two places (positions interposing an opening) separated from an end portion of an opening on one side of a 300 micron SUS plate, which is provided with an opening having a size of 1 mm square, by 2 cm, and then a glass plate was pasted thereon to block the opening. The resin composition
10 having a size of 1 cm square was placed (on the SUS plate) so as to cover the opening part of the SUS plate of which surface pasted with the glass plate faces downward. A predetermined weight of a load was placed on the resin composition placed on the SUS plate, and this product was heated in this state for a predetermined time in an oven
15 under the following conditions, thereby preparing test pieces according to Examples 1 to 5 and Comparative Examples 1 and 2.

· Oven: SAFETY OVEN SPH-201 manufactured by ESPEC CORP.

· Temperature: 140°C

[0053] <Evaluation>

20 (1) Evaluation of Adhesiveness between Resin Composition and Silicon Chip

Regarding the test pieces according to Examples 1 to 5 and Comparative Examples 1 and 2, the substrate was observed from the side to which the glass plate was attached, and the amount of the resin flowing into the gap between the glass plate and the substrate was checked. The flowing amount was obtained, in a case where one side of the resin composition was designated as "a," as a ratio with respect to "a."

[0054] Thereafter, adhesiveness between the substrate and the glass plate was measured under the following conditions.

· Adhesive force measurement apparatus: DAGE-4000HS manufactured by ARCTEC, Inc.

[0055] The sticking force obtained by the adhesiveness measurement was evaluated on the basis of the following evaluation criteria.

A: 10 MPa or more

B: less than 10 MPa

(2) Temperature Cycle Test (TCT) Evaluation of Resin Composition

[0056] The same test pieces as those in the evaluation method (1) were prepared and the temperature cycle test was performed by the following method.

· Apparatus: TSA-41L-A manufactured by ESPEC CORP.

· Temperature: -40°C for 30 minutes, 80°C for 30 minutes (1 cycle)

· Number of times: 1,000 cycles

After 1,000 cycles, a case where the substrate and the glass plate were separated was evaluated as B, and a case where the substrate and the glass plate were not separated was evaluated as A.

[0057] <Evaluation Result>

In Table 2, regarding each of Examples 1 to 5 and Comparative Examples 1 and 2, evaluation results of the weight of the load used at the time of heating, the amount of the resin flowing (distance), adhesiveness, and the temperature cycle test (TCT) are presented.

5 [0058] [Table 2]

	Example 1	Example 2	Example 3	Example 4	Example 5	Comparative Example 1	Comparative Example 2
Load (kg)	1.2	1.4	1.6	1.8	2.0	1.0	0.7
Distance	0.1a	0.2a	0.5a	0.7a	0.9a	0	-0.5a
Adhesiveness	A	A	A	A	A	B	B
TCT	A	A	A	A	A	B	B

Reference Signs List

[0059] 1: hollow sealing structure, 10: substrate, 20: electronic component, 25: Au bump, 30: sealing part, 40: sealing material sheet.

CLAIMS

1. An hollow sealing structure comprising:

a substrate;

5 an electronic component that is disposed on projecting parts provided on the substrate, the electronic component being separated from the substrate; and

a sealing part formed from an insulating material, the sealing part sealing the electronic component in a state in which a hollow region is formed between the electronic component and the substrate, wherein
10 in the entire periphery of the outer periphery of the electronic component in plan view, the sealing part enters from the outer periphery between the electronic component and the substrate.

2. The hollow sealing structure according to claim 1, wherein the sealing part entering between the electronic component and the substrate is separated from the projecting part.
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3. The hollow sealing structure according to claim 1 or 2, wherein a ratio of an area of the sealing part entering between the electronic component and the substrate in plan view is 1% to 30% with respect to an area of the electronic component in plan view.
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