

DESCRIPTION

TITLE OF THE INVENTION: METAL SUPPORT FLEXIBLE BOARD, METAL SUPPORT CARRIER TAPE FOR TAPE AUTOMATED BONDING USING SAME, METAL SUPPORT FLEXIBLE CIRCUIT BOARD FOR MOUNTING LED, AND COPPER FOIL-LAMINATED METAL SUPPORT FLEXIBLE CIRCUIT BOARD FOR FORMING CIRCUIT

TECHNICAL FIELD

[0001]

The present invention relates to a metal support flexible printed circuit board. More specifically, the present invention relates to a metal support flexible board for electronic parts, which is suitable for preparing boards for connecting semiconductor devices, used in mounting a semiconductor integrated circuit (IC), such as interposers for tape automated bonding (TAB) or ball grid array (BGA) package, and boards for mounting an LED or power devices.

BACKGROUND ART

[0002]

The flexible board is a board for forming a circuit which is composed of a support, an adhesive, a conductor layer for forming a circuit and the like, and has excellent flexibility, and is a wiring plate which is widely used for routing various wirings of electronic equipment, or as an interposer for mounting

an IC by mounting intended functional parts on a circuit layer of a conductor formed, and then protecting a circuit by a solder resist or a cover lay film.

[0003]

At the present time when a variety of electronic parts are developed with the spread of the electronic equipment, power consumption per volume of the circuit board continues to increase with downsizing and increase in density of electronic parts. Also in the flexible circuit board, it is required to achieve both of a large number of advanced required characteristics according to the site of application and an improvement in safety simultaneously. Particularly, in the flexible circuit board for mounting a driver IC for driving a plasma display in which an amount of heat generation is large because of a high driving voltage and also high insulating performance is required, or in the flexible circuit board for mounting an LED device having a large amount of local heat generation due to light emission, there is an object of improving heat resistance and ease of heat dissipation scheme while maintaining insulating performance and low curling properties as a technique to realize higher functions, higher speed and higher output.

[0004]

Therefore, a board, which can prevent the insulation breakdown by wire bonding by using a metal board having high heat dissipation properties as a board of a circuit device, and

disposing silica sol-based inorganic varnish as an insulating layer on the metal board, is proposed (for example, refer to Patent Document 1).

[0005]

However, since the silica sol-based inorganic varnish does not have flexibility, in the flexible circuit board, there are problems that cracks are produced in the insulating layer, a processing flow based on a reel-to-reel process becomes impossible because the amount of curl of the flexible circuit board is large, and it is difficult to control a semi-cured state of a resin layer or to obtain punching properties in order to use the silica sol-based inorganic varnish for an automated bonding method.

[0006]

Further, as a method of utilizing the metal support layer, a TAB tape carrier for a liquid crystal display device characterized in that an adhesive is applied onto a base metal as a base and a copper pattern is formed thereon is proposed (for example, refer to Patent Document 2).

[0007]

However, since this board has a configuration in which a conductive layer is present directly below the insulating layer, and the formed circuit is disposed directly above the insulating layer, insulating performance is insufficient for applying the board as a driver IC for a plasma display having a high driving

voltage or as a board for LED mounting having a large amount of heat generation, while maintaining insulating properties between circuit wirings and insulating properties between each circuit wiring and a support metal layer. Moreover, in the case where a copper foil for forming a circuit is sequentially laminated in a customer's process like in the tape automated bonding method, the adhesive layer is sandwiched between the copper foil for forming a circuit and the support copper foil and there is no refuge of the water absorbed by the adhesive layer, and therefore, there is a problem that foaming is produced in the adhesive layer.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0008]

Patent Document 1: Japanese Unexamined Patent Publication
No. 8-288605

Patent Document 2: Japanese Unexamined Patent Publication
No. 8-055880

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0009]

It is an object of the present invention to provide a metal support flexible board which has excellent wire bonding

properties and low curling properties while maintaining excellent insulating properties and punching properties, and therefore can be subjected to a reel-to-reel process and facilitates packaging scheme and heat dissipation scheme.

MEANS FOR SOLVING THE PROBLEMS

[0010]

In order to solve the above-mentioned problems, in a metal support flexible board of the present invention, a support is composed of a metal foil, and (1) an adhesive layer contains (A) a polyamide resin containing a dimer acid residue and (B) a phenol resin.

EFFECTS OF THE INVENTION

[0011]

In accordance with the present invention, since a metal support flexible board has excellent wire bonding properties and low curling properties while maintaining excellent insulating properties and punching properties, it becomes possible to facilitate packaging scheme and heat dissipation scheme. Electronic parts using the metal support flexible board of the present invention have chemical resistance necessary for circuit processing and insulating properties which enable high-voltage driving in a circuit of a metal support board, can be easily subjected to a reel-to-reel process and a punching

process and is easy to form a flying lead, and therefore the electronic parts enable a more simple heat dissipation scheme at lower cost than conventional electronic parts.

MODE FOR CARRYING OUT THE INVENTION

[0012]

Hereinafter, the present invention will be described in detail.

[0013]

In a metal support flexible board of the present invention, (1) an adhesive layer contains (A) a polyamide resin containing a dimer acid residue.

[0014]

A dimer acid in the polyamide resin (A) containing a dimer acid residue is a dibasic acid in a region of the highest molecular weight industrially obtained, and has high hydrophobicity since the dimer acid has a bulky hydrocarbon group. Thus, a dimer acid polyamide resin derived from the dimer acid is tough and rich in flexibility because of its low crystallinity, and has solubility in an organic solvent, which is necessary for realizing the metal support flexible board of the present invention, while maintaining low water absorption coefficient. Moreover, the dimer acid has hydrolysis resistance and flame resistance which are derived from strong bonding strength of an amide bond. Therefore, by using the polyamide resin having

a dimer acid residue, punching properties in a tape automated bonding method and similar methods are well maintained while maintaining chemical resistance, flame resistance and low curling properties required of a flexible board. Further, it is possible to well suppress foaming due to the water which a resin absorbs at the time of completely curing an adhesive after disposing a metal layer for a circuit after punching. A polyamide resin having a dicarboxylic acid residue having 36 carbon atoms is preferred from the viewpoint of toughness, film forming property and processability. As the polyamide resin having a dimer acid residue, various publicly known resins can be used, and two or more of them may be used.

[0015]

The polyamide resin having a dimer acid residue is prepared by polycondensation of a dimer acid and a diamine according to a normal method, and in this polycondensation, the polyamide resin may contain a dicarboxylic acid other than the dimer acid, such as adipic acid, azelaic acid or sebacic acid as a copolymerization component. As the diamine, publicly known diamines such as ethylene diamine, hexamethylene diamine and piperazine can be used, and two or more of them may be used.

[0016]

In the present invention, an amine number of the polyamide resin having a dimer acid residue is preferably 0.5 to 10, and more preferably 0.5 to 8. The amine number referred to herein

is an amount in milligram of potassium hydroxide equivalent to hydrochloric acid required in titrating 1 g of a polyamide resin. When two or more kinds of polyamide resins are contained, the amine number refers to an amine number represented by an amount in milligram of potassium hydroxide equivalent to hydrochloric acid required in titrating 1 g of a resin mixture obtained by mixing two or more kinds of polyamide resins in the ratio of contents of the resins in the adhesive layer (1). When the amine number is 0.5 or more, the cross-linking density of the adhesive layer (1) is high, and not only chemical resistance to an alkaline solution or a mixed liquid of organic acid and insulation durability of the resulting flexible board are improved, but also it becomes possible to minimize resin deformation against wire bonding and thermal pressure of flip chip when mounting an IC and to avoid the contact between the metal support layer and the wire. When the amine number is 10 or less, since the absolute value of the amount of curl of a wiring board obtained after processing can be reduced and the cross-linking reaction rate of the adhesive can be kept at a proper level, it becomes possible to obtain preservation stability in a semi-cured state of the adhesive and stability in a processing step.

[0017]

The polyamide resin having a dimer acid residue preferably has a melt viscosity at 190°C of 10 Pa·s or more, and more preferably 20 Pa·s or more. When the melt viscosity at 190°C is 10 Pa·s

or more, since the film forming property of the adhesive layer (1) or the durability against foaming due to the absorbed water can be attained in main curing of the adhesive layer (1), it enables more stable processing. The melt viscosity at 190°C is preferably 190 Pa·s or less, and more preferably 100 Pa·s or less. When the melt viscosity at 190°C is 190 Pa·s or less, since it is unnecessary to treat the metal layer for forming a circuit when it is disposed, it is possible to minimize thermal degradation or generation of thermal stress of the circuit layer. Herein, the melt viscosity at 190°C can be measured according to apparent viscosity measurement described in the annex C of JIS K 7210-1999. When two or more kinds of polyamide resins are contained, a resin mixture obtained by mixing the polyamide resins in the ratio of contents of the resins in the adhesive layer (1) is used to measure the melt viscosity.

[0018]

The polyamide resin having a dimer acid residue preferably contains a polyether amide resin. The polyether amide resin is highly flexible even when its molecular weight is increased and the absolute value of the amount of curl of a wiring board obtained after processing can be reduced.

[0019]

Further, in the metal support flexible board of the present invention, the adhesive layer (1) contains (B) a phenol resin. The phenol resin is not particularly limited as long as it is

a resin which contains two or more phenolic hydroxyl groups in a molecule, and any of publicly known phenol resins such as novolac phenol resins and resol phenol resins may be used. Specific examples of the phenol resins include alkyl-substituted phenols such as phenol, cresol, p-t-butylphenol, nonylphenol and p-phenylphenol; cyclic alkyl-modified phenols such as terpene and dicyclopentadiene; phenol resins having a functional group containing a heteroatom such as a nitro group, a halogen group, a cyano group and an amino group; phenol resins having a skeleton of naphthalene, anthracene or the like; and resins made of polyfunctional phenols such as bisphenol F, bisphenol A, bisphenol S, resorcinol and pyrogallol. Further, two or more of them may be used, and resol phenol resins are preferably used from the viewpoint of insulation reliability.

[0020]

In the adhesive layer (1) of the present invention, the content of the phenol resin (B) is preferably 10 parts by weight or more, and more preferably 30 parts by weight or more with respect to 100 parts by weight of the polyamide resin (A) containing a dimer acid residue. Further, the content is preferably 200 parts by weight or less, and more preferably 160 parts by weight or less. When the content of the phenol resin (B) is 10 parts by weight or more, insulation reliability, and adhesion durability under high-temperature/high-humidity treatment are improved, and when the content of the phenol resin

(B) is 200 parts by weight or less, the flexibility of the adhesive layer is excellent.

[0021]

In the present invention, the adhesive layer (1) may contain (C) an epoxy resin. The epoxy resin is preferably an epoxy resin having two or more epoxy groups, and examples of preferable epoxy resins include glycidyl ethers such as bisphenol A, bisphenol F, bisphenol S, resorcinol, dihydroxynaphthalene, dicyclopentadiene diphenol and dicyclopentadiene dixylenol, and resins having a chemical structure of phenol novolac, cresol novolac, trisphenylol methane, epoxidized tetraphenylol ethane, epoxidized methaxylenediamine, cyclohexeneoxide, bicycloheptene oxide or cyclopentene oxide. Epoxy resins having three or more chemical reaction sites selected from the group consisting of an allyl group, a methallyl group, an amino group, a hydroxyl group and a carboxyl group besides the epoxy group are also preferred. When the epoxy resin contains two or more different chemical reaction sites, it is only required that the total number of the chemical reaction sites of all kinds which are contained in a unit molecule of the epoxy resin is three or more. The position of the chemical reaction site is not particularly limited, but the epoxy resin preferably has the chemical reaction site on at least the side chain. Further, two or more kinds of the above-mentioned epoxy resins may be used.

[0022]

In the present invention, the adhesive layer (1) may contain (D) a hardening accelerator. Examples of the hardening accelerator include publicly known hardening accelerators, for example, aromatic polyamines, imidazole derivatives such as 2-alkyl-4-methylimidazole and 2-phenyl-4-alkylimidazole, dicyandiamide, triphenylphosphine, and diazabicycloundecene. Two or more of them may be used.

[0023]

In the present invention, the adhesive layer (1) may contain (E) a filler. The filler is not particularly limited as long as it does not impair characteristics of the adhesive, and examples of an inorganic filler include fine particles of metals such as gold, silver, copper, iron, nickel and aluminum; metal hydroxides such as magnesium hydroxide, aluminum hydroxide and calcium-aluminate hydrate; metal oxides such as aluminum oxide, zirconium oxide, zinc oxide, antimonous oxide, antimony pentoxide, aluminum oxide, magnesium oxide, titanium oxide, ferric oxide, cobalt oxide, chromium oxide and talc; inorganic salts such as silicon carbide, titanium carbide silica, aluminum nitride, titanium nitride, silicon nitride and calcium carbonate; carbon black; silica; and glass. Among these, silica, alumina, aluminum nitride, magnesium hydroxide and aluminum hydroxide are preferably used. Herein, silica may be amorphous or crystalline, and amorphous silica or crystalline silica is

appropriately selected in accordance with their properties. These inorganic fillers may be subjected to a surface treatment using a silane coupling agent or the like for the purpose of improving an adhesive property and a filling property. The diameter of particles of the inorganic filler is not particularly limited, but the average particle diameter is preferably 0.02 to 30 μm from the viewpoint of dispersibility, coatability and transparency.

[0024]

Examples of an organic filler include cross-linked polymers such as styrene, NBR rubber, acrylic rubber, polyamide, polyimide and silicone. The average particle diameter of fine particles of the organic filler is preferably 0.2 to 5 μm in consideration of dispersion stability.

[0025]

Beside the above-mentioned components, it is not hindered at all that the adhesive layer contains an antioxidant, an ion scavenger and the like as long as the properties of the adhesive are not impaired. The antioxidant is not particularly limited as long as it provides an antioxidant function, and publicly known antioxidants such as phenolic antioxidants, thioether-based antioxidant, phosphorus-based antioxidants and amine-based antioxidants can be used. Two or more of them may be used.

[0026]

In the metal support flexible board of the present invention, the support (2) is composed of a metal foil. By employing a metal foil for the support, thermal conductivity of the circuit board is improved and the size of a heat dissipation plate can be minimized. Moreover, since the metal support flexible board of the present invention is easy to form a device hole by punching processing or the like, by mounting parts to be mounted such as an IC or an LED device from the backside of the surface on which the circuit is formed by use of the device hole, the support (2) itself can be used as a heat dissipation plate, or thermal conductivity to a heat sink can be improved.

[0027]

As the metal, a copper foil, a stainless steel foil or an aluminum foil is preferably used. A copper alloy foil, a nickel foil, a magnesium foil, a titanium foil, or foils of alloys containing these metals may be used in addition to phosphor bronze in accordance with intended usage and required functions, and a metal foil having a coefficient of thermal expansion of 10 to 30 ppm/°C can be suitably selected according to the balance of the entire packaging. The thickness of the support (2) can be suitably selected according to the required flexibility or the tearing strength, but a thickness of 12 to 150 μm is preferably used, and a thickness of 12 to 75 μm is more preferably used.

[0028]

Further, the a metal foil of the support (2) may be subjected

to a surface treatment such as an organic/inorganic coupling treatment, plating, resin coating or ceramic layer formation for the purpose of imparting easy adhesion or insulating properties of the adhesive layer (1), modifying apparent gloss or avoiding chemical exposure during forming a circuit, and (3) a support-covering layer may be formed on the adhesive layer (1) side of the support (2) and/or the opposite side thereof.

[0029]

The thickness of the support-covering layer (3) is preferably 2 μm or more, and more preferably 2.5 μm or more as a lower limit from the viewpoint of the balance between covering strength and reel handling properties or from the viewpoint of enhancing the reliability of insulation between the support (2) and a circuit conductor layer. The thickness of the support-covering layer (3) is preferably 100 μm or less, and more preferably 10 μm or less as an upper limit. The thickness is moreover preferably less than 5 μm . The layer structure of the support-covering layer (3) may be a single layer or may be plural layers.

[0030]

When a resin is used for the support-covering layer (3), the resin is not particularly limited, but a polyimide resin or a polyamide-imide resin, which has excellent heat resistance and chemical resistance, is preferably used, and particularly the polyamide-imide resin is preferably used from the viewpoint

of imparting chemical resistance and easy adhesion. The polyamide-imide resin is particularly preferred since it can provide a high adhesion force to the adhesive layer (1) of the present invention containing (A) a polyamide resin containing a dimer acid residue and (B) a phenol resin. It is preferred that the polyamide-imide resin used for the support-covering layer (3) has a Tg (glass transition temperature) of 300°C or more and a weight average molecular weight of 10000 or more from the viewpoint of heat resistance and chemical resistance, and that an epoxy resin is mixed in an amount of 5% by weight or more and cured in the polyamide-imide resin in order to provide a high adhesion force to the adhesive layer (1) of the present invention.

[0031]

The support-covering layer (3) may be disposed as required on either side of the adhesive layer (1) side and the opposite side thereof in accordance with the purpose, and releasability may be imparted to the support-covering layer (3) on either side or the support-covering layers (3) on both sides. The releasability refers to the property that the support-covering layer (3) can be peeled off without causing peeling of part of the support (2) from the support (2) provided with the support-covering layer (3), or without leaving part of the support-covering layer (3) on the surface of the support (2) or causing peeling at another interface. When the releasability

is imparted to the support-covering layer (3) on the adhesive layer (1) side, it becomes possible to make a product after processing base material-less, and when the releasability is imparted to the support-covering layer (3) on the opposite side of the adhesive layer (1) side, it becomes possible to attain a board with a high heat dissipation property making use of the support (2) while maintaining chemical resistance for an existing circuit process line. In this case, it is preferred that the support-covering layer (3) has a layer structure of two or more layers, a first layer in contact with the support (2) is composed of an adhesive material and/or a thermoplastic resin, and at least one layer other than the first layer is made of one or more substance selected from among polyester, polyolefin, polyphenylene sulfide, polyvinyl butyral, polyvinyl acetate, polyvinyl alcohol, polycarbonate, polyamide, polyimide, polyamide-imide and polymethyl methacrylate. Thereby, the first layer has releasability, and the above-mentioned at least one layer other than the first layer can have tensile strength at the time of peeling and can be easily peeled off while maintaining chemical resistance during circuit processing.

[0032]

Further, in the case where device holes, sprocket holes or the like are formed by, for example, punching, a hole cross-section may be subjected to a treatment such as resin coating by electrodeposition coating or oxide film formation

to further add (4) a hole cross-section-covering layer for the purpose of protecting insulation or avoiding chemical exposure during circuit formation. When a resin is used for the hole cross-section-covering layer (4), an epoxy resin, a polyimide resin, a polyamide-imide resin or an acrylic resin, which is excellent in insulating properties, heat resistance and chemical resistance, is preferably used.

[0033]

In forming a circuit, for the purpose of avoiding chemical exposure of the support (2) and cross-sections of a device hole and a sprocket hole, which are formed by punching, a photoresist is preferably applied onto an entire surface of the metal support flexible board and a back material is preferably applied onto an entire surface opposite to the adhesive layer (1) of the support (2).

[0034]

Although chemicals are often used in forming a circuit, it is possible to avoid the chemical exposure of a part where the support (2) is exposed without having the adhesive layer (1) on the support (2), by applying the photoresist onto an entire surface of the metal support flexible board, and thereby, damages of the metal support flexible board can be prevented. Further, the chemical exposure of a cross-section of a device hole and a cross-section of a sprocket hole can be avoided by applying the back material onto an entire surface opposite to the adhesive

layer (1) of the support (2).

[0035]

The metal support flexible board of the present invention may be processed into a metal support carrier tape by maintaining the adhesive layer (1) in a semicured state and disposing (5) a protective film prior to disposing of a metal layer for forming a circuit. A material of the protective film is not particularly limited as long as it can be peeled off without impairing the configuration and function of the adhesive layer (1), and examples of the material include films of plastics such as polyester, polyolefin, polyphenylene sulfide, polyvinyl chloride, polytetrafluoroethylene, polyvinylidene fluoride, polyvinyl fluoride, polyvinyl butyral, polyvinyl acetate, polyvinyl alcohol, polycarbonate, polyamide, polyimide and polymethyl methacrylate; these films subjected to a coating treatment by a releasing agent such as silicone or a fluorine compound; paper prepared by laminating these films; and paper impregnated or coated with a resin having releasability.

[0036]

In the metal support carrier tape, it becomes possible to form a wiring with an air gap (flying lead) in a device hole by forming required device holes by punching processing or the like, then peeling a protective film off, and disposing a metal layer for forming a circuit by a laminating method or a pressing method. In the case of mounting using a flying lead, since an

IC, an LED device or the like can be mounted from both of the front and the back of the metal support carrier tape, not only the ease of layout and heat dissipation scheme of parts to be mounted are improved, but also insulation breakdown between a metal layer of the support and a layer forming a circuit due to compression failure of the insulating layer, which is a problem in a wire bonding method, can be further avoided.

[0037]

Next, a method for producing a metal support flexible board of the present invention will be described by way of examples.

[0038]

(a) A resin composition composing the adhesive layer (1) is dissolved in a solvent to form an adhesive coating material, and the adhesive coating material is applied onto the support (2) and dried to form (1) an adhesive layer, and thereby, the metal support flexible board of the present invention is obtained. The film thickness of the adhesive layer (1) is not particularly limited as long as it satisfies required functions such as adhesive properties, insulating properties and thermal conductivity, and the resin composition is preferably applied so as to have a thickness of the adhesive layer (1) of 2 to 200 μm , and more preferably 2 to 50 μm in order to maintain the flexibility of the layer. An application method is not particularly limited, and ordinary application facilities of a comma system, a lip system, a roll system, a Mayer bar system,

a gravure system or the like may be appropriately used in accordance with the properties of the coating material. Drying conditions are generally 100 to 200°C and 1 to 5 minutes. The solvent is not particularly limited, and aromatic solvents such as toluene, xylene and chlorobenzene; ketone solvents such as methyl ethyl ketone and methyl isobutyl ketone; aprotic solvents such as dimethylformamide, dimethylacetamide and N-methylpyrrolidone; and alcoholic solvents such as ethanol, methanol, isopropyl alcohol, N-butanol and benzyl alcohol are suitable, and two or more of them may be used. Further, when the hardening accelerator (D) or the filler (E), which is insoluble in a solvent, is used, a method in which the hardening accelerator (D) or the filler (E) is dispersed in a solvent in advance by use of a homomixer, a bead mill, a sand mill, a dispersion apparatus of a cavitation system or the like, or a method in which the hardening accelerator (D) or the filler (E) is kneaded/dispersed in any one or more of the resins composing the adhesive layer (1) by use of an extruder, a Banbury mixer or the like can be suitably employed.

[0039]

(b) The protective film (5) having releasability may be laminated on the adhesive layer (1) formed by the method described in the paragraph (a), as required, to prepare the metal support flexible board of the present invention. Moreover, when the thickness of the adhesive layer is increased, a coating material

may be applied again onto the applied coating material, or the formed plural adhesive layers (1) may be laminated. Further, the adhesive layer (1) may be formed on the protective film (5) in advance and the support (2) may be laminated to obtain the metal support flexible board of the present invention. When the support-covering layer (3) is disposed on the support (2), it is preferred to prepare a coating material prepared by dissolving or dispersing a resin to serve as the support-covering layer (3) in an organic solvent in advance, and applying the coating material onto the support (2) in a predetermined thickness, and drying the coating material to form the support-covering layer (3). Moreover, when the support-covering layer (3) having releasability is disposed, it is preferred to stick a multilayer structure, which is obtained by applying the releasable resin layer onto a film for maintaining tensile strength necessary for peeling and drying the layer, to the support (2) in advance by a laminating method or the like.

[0040]

Conditions of laminating the adhesive layer (1) onto the support (2) are generally a temperature of 50 to 160°C and a pressure of 0.1 to 0.5 MPa. The laminating temperature is preferably 140°C or less, and a laminating temperature of 120°C or less can be considered to be good and a laminating temperature of 100°C or less can be considered to be extremely good. When the support-covering layer (3) is formed on the adhesive layer

(1) side of the support (2), the adhesive layer (1) is laminated onto the support (2) provided with the support-covering layer (3), and also in this case, lamination is preferably performed in the same conditions as those in the case where the adhesive layer (1) is directly laminated onto the support (2).

[0041]

After obtaining the metal support flexible board of the present invention, the metal support flexible board may be heat treated, for example, at 40 to 100°C for about 20 to 300 hours to adjust the degree of cure of the adhesive layer (1). When the degree of cure is adjusted, there are the effects of preventing an excessive flow of the adhesive at the time of disposing a metal layer for forming a circuit in the metal support flexible board and preventing foaming due to water during heating and curing.

[0042]

When a circuit using the metal support flexible board of the present invention is processed, in the case of providing the formed device hole or sprocket hole with (4) a hole cross-section-covering layer, the hole cross-section-covering layer (4) is preferably formed by an electrodeposition coating method after forming a hole by punching or the like. As the electrodeposition coating method, it is preferred to employ a cation electrodeposition coating method in which a negative voltage is applied to the support (2), and the epoxy resin-based

or polyimide resin-based electrodeposition coating material positively polarized is deposited at the hole cross-section of the support (2). Further, after the electrodeposition coating is performed, the electrodeposition coating material is preferably heated and fixed.

[0043]

Electronic parts using the metal support flexible board of the present invention have chemical resistance necessary for circuit processing and insulating properties necessary for a metal support board, can be easily subjected to a reel-to-reel process and a punching process and is easy to form a flying lead, and therefore the electronic parts enable a more simple heat dissipation scheme at lower cost than conventional electronic parts.

EXAMPLES

[0044]

Examples of an embodiment of the present invention will be described below, but the present invention is not limited to these examples. First, evaluation methods in examples and comparative examples will be described.

[0045]

(1) Evaluation of Insulation Reliability of Metal Support Flexible Circuit Board

A voltage of 100 V was applied to each of the metal support

flexible circuit boards (conductor width 50 μm , distance between conductors 50 μm) obtained in examples and comparative examples under the atmosphere of 130°C and 85% RH, and the time elapsed until the resistance value was decreased to $10^6 \Omega$ or less was taken as an endurance time of insulation. The endurance time of insulation is preferably 250 hours or more.

[0046]

(2) Evaluation of Amount of Curl of Metal Support Flexible Board

After each of the copper foils for forming a circuit of the metal support flexible boards with a copper foil for forming a circuit obtained in examples and comparative examples was removed by a subtractive method (etching) using ferric chloride, the board was cut into a size of 35 mm $\times$ 190 mm to form a metal support flexible board for evaluation of the amount of curl. The metal support flexible board for evaluation of the amount of curl was subjected to humidity conditioning at 23°C and 55% RH for 24 hours, and then the maximum height from a glass plate of a circuit board having a cured cover lay film adhered was measured with an end of a curled board placed upward on the glass plate to take the maximum height as the amount of curl. An amount of curl of 7 mm or less can be considered as good, and an amount of curl of 3 mm or less can be considered as extremely good.

[0047]

(3) Evaluation of Foaming of Metal Support Flexible Board

The adhesive layer (1) of the metal support flexible board for evaluation of the amount of curl in the paragraph (2) was observed with a metallograph and foaming of the board was evaluated. A foam having a diameter of 5 μm or more was taken as being foamed, and a board having no foam was rated as $\circ$, a board, in which 1 to 10 foams having a diameter of 5 μm or more and less than 50 μm were found, was rated as Δ , and a board, in which a foam having a diameter of 50 μm or more was found or 11 or more foams having a diameter of 5 μm or more and less than 50 μm were found, was rated as $\times$. A board rated as Δ or better can be considered as good, and a board rated as $\circ$ can be considered as extremely good.

[0048]

(4) Evaluation of Pressure Welding Resistance of Metal Support Flexible Circuit Board

Hot pressing was applied to each of the metal support flexible circuit boards (conductor width 50 μm , distance between conductors 50 μm) obtained in examples and comparative examples with an ACF bonder (TCW-125 manufactured by NIPPON Avionics co., ltd.) at 200°C for 1 second in such a way that the tool pressure was 50 g/2500 μm^2 per one wire, and pressure welding resistance of wire bonding was evaluated. The sinking amount of circuit patterned copper of a sample for evaluation of pressure welding resistance at a surface of pressure welding by a tool was measured. A sinking amount of 3.0 μm or less can be judged as acceptable,

a sinking amount of 2.0 μm or less can be judged as good, and a sinking amount of 1.0 μm or less can be judged as extremely good.

[0049]

(5) Evaluation of Punching Properties of Metal Support Flexible Board

Round holes of 0.250 mm ϕ , 0.350 mm ϕ , and 0.500 mm ϕ were punched in each of the metal support flexible boards obtained in examples and comparative examples by using a press die, and a cut surface thereof was observed to evaluate punching properties. When, in a cross-section of the hole, there was no shear drop or burr of the adhesive layer (1) having a length of 10 μm or more, or there were no cracks or chips of the adhesive layer (1) having a length of 10 μm or more, and there was no peeling from the support (2) around the hole, the board can be judged to be extremely good in that a device hole or a via hole can be well formed for forming a flying lead or for designing a device. When there was no shear drop or burr of the adhesive layer (1) having a length of 20 μm or more, or there were no cracks or chips of the adhesive layer (1) having a length of 20 μm or more, there was no peeling from the support (2) around the hole, the board is judged to be good. When, in a cross-section of the hole, there was shear drop or burr of the adhesive layer (1) having a length of 20 μm or more, or there were cracks or chips of the adhesive layer (1) having a length of 20 μm or more,

and there was peeling from the support (2) around the hole, the board can be judged to be defective.

[0050]

(6) Evaluation of Chemical Resistance of Metal Support Flexible Board and Metal Support Flexible Board with Sprocket Holes

The metal support flexible boards and the metal support flexible boards with sprocket holes obtained in examples and comparative examples were immersed in 1. a ferric chloride solution (40°C, 37%), 2. a sodium hydroxide solution (30°C, 1 N), and 3. an electroless tinplating solution (70°C, "Timposit" LT-34, manufactured by Rohm and haas company), and then the appearances of these flexible boards were observed to evaluate the chemical resistance. Evaluation criteria are as follows.

[0051]

(6-1) Case of Metal Support Flexible Board

Rank A: The flexible board satisfies both of the following requirements (i) and (ii) when it is immersed in the chemical of 1 for 5 minutes, then in the chemical of 2 for 5 minutes, and further in the chemical of 3 for 5 minutes successively.

Rank B: The flexible board does not satisfy the requirement of the rank A but satisfies both of the following requirements (i) and (ii) when it is immersed in the chemical of 1 for 3 minutes, then in the chemical of 2 for 3 minutes, and further in the chemical of 3 for 3 minutes successively.

Rank C: The flexible board satisfies the following requirement (i) but does not satisfy the following requirement (ii) when it is immersed in the chemical of 1 for 3 minutes, then in the chemical of 2 for 3 minutes, and further in the chemical of 3 for 3 minutes successively.

Rank F: The flexible board does not satisfy both the following requirements (i) and (ii) when it is immersed in the chemical of 1 for 3 minutes, then in the chemical of 2 for 3 minutes, and further in the chemical of 3 for 3 minutes successively.

(i) There is no significant damage due to the chemical in the surface appearance of the adhesive layer (1).

(ii) When the support-covering layer (3) is not formed on the side opposite to the adhesive layer (1) of the support (2), there is no significant damage due to the chemical in the surface appearance on the side opposite to the adhesive layer (1) of the support (2). Further, when the support-covering layer (3) is formed on the side opposite to the adhesive layer (1) of the support (2), there is no significant damage due to the chemical in the surface appearance on the side opposite to the support (2) side of the support-covering layer (3) formed on the side opposite to the adhesive layer (1) of the support (2).

[0052]

(6-2) Case of Metal Support Flexible Board with Sprocket Holes

Rank A: The flexible board satisfies all of the following

requirements (i) to (iii) when it is immersed in the chemical of 1 for 5 minutes, then in the chemical of 2 for 5 minutes, and further in the chemical of 3 for 5 minutes successively.

Rank A' : The flexible board does not satisfy the requirement of the rank A but satisfies all of the following requirements (i) to (iii) when it is immersed in the chemical of 1 for 3 minutes, then in the chemical of 2 for 3 minutes, and further in the chemical of 3 for 3 minutes successively.

Rank B: The flexible board satisfies any two of the following requirements (i) to (iii) when it is immersed in the chemical of 1 for 3 minutes, then in the chemical of 2 for 3 minutes, and further in the chemical of 3 for 3 minutes successively.

Rank C: The flexible board satisfies any one of the following requirements (i) to (iii) when it is immersed in the chemical of 1 for 3 minutes, then in the chemical of 2 for 3 minutes, and further in the chemical of 3 for 3 minutes successively.

Rank F: The flexible board does not satisfy any of the following requirements (i) to (iii) when it is immersed in the chemical of 1 for 3 minutes, then in the chemical of 2 for 3 minutes, and further in the chemical of 3 for 3 minutes successively.

(i) There is no significant damage due to the chemical in the surface appearance of the adhesive layer (1).

(ii) When the support-covering layer (3) is not formed on the side opposite to the adhesive layer (1) of the support (2), there is no significant damage due to the chemical in the

surface appearance on the side opposite to the adhesive layer (1) of the support (2). Further, when the support-covering layer (3) is formed on the side opposite to the adhesive layer (1) of the support (2), there is no significant damage due to the chemical in the surface appearance on the side opposite to the support (2) side of the support-covering layer (3) formed on the side opposite to the adhesive layer (1) of the support (2).

(iii) There is no significant damage due to the chemical in a cross-section of a hole.

[0053]

(7) Adhesion Force of Metal Support Flexible Circuit Board

Using each of the metal support flexible circuit boards (conductor width 50 μm) obtained in examples and comparative examples, the conductor was peeled off at a speed of 50 mm/min in a direction of 90 degrees with Tensilon UTM-11-5HR (manufactured by Japan Baldwin Technology Company, Inc.) and peeling strength at peeling was measured. When the peeling strength is 8 N/cm or more, the adhesion force can be judged to be extremely good, and when the peeling strength is 6 N/cm or more, the adhesion force can be judged to be good.

[0054]

(Example 1)

(a) Preparation of Adhesive Layer Sheet

A mixed solvent of ethanol and toluene (mixing ratio in weight between ethanol and toluene: 1 : 4) was added to 100 parts

by weight of (A) a dimer acid polyamide resin ("SUNMIDE" (registered trademark) HT-100G, manufactured by Airproducts Japan co., ltd., amine number 1, melt viscosity 7.0 Pa.s), 50 parts by weight of (B) a resol phenol resin (CKM1634 manufactured by SHOWA HIGHPOLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator (2-ethyl-4-methylimidazole (2E4MZ) manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.), and the resulting mixture was stirred and mixed at 30°C to prepare an adhesive composition having a solid content concentration of 25% by weight. The adhesive composition was applied onto (5) a protective film (polyethylene terephthalate film ("FILMBYNA" (registered trademark) GT manufactured by FUJIMORI KOGYO co., ltd.) with a silicone releasing agent, having a thickness of 25 μ m) with a bar coater so as to have a dried thickness of about 12 μ m, and dried at 150°C for 4 minutes, and then another protective film (5) was stuck to the surface of the resulting adhesive layer (1) to prepare an adhesive layer sheet sandwiched between the protective films (5).

[0055]

(b) Preparation of Metal Support Flexible Board and Metal Support Flexible Circuit Board

One of the protective films (5) of the adhesive layer sheet

obtained by the method described in the paragraph (a) was peeled off and laminated on (2) a support (rolled copper foil (BHY-22B-T, thickness 70 μm (manufactured by Nippon Mining & Metals Co., Ltd.), coefficient of linear expansion 16.0 ppm/ $^{\circ}\text{C}$)) under the conditions of 100 $^{\circ}\text{C}$ and 0.3 MPa to obtain a metal support flexible board.

[0056]

The protective film (5) of the metal support flexible board was peeled off, and an electrolytic copper foil having a thickness of 18 μm was laminated on the metal support flexible board under the conditions of 140 $^{\circ}\text{C}$ and a pressure of 0.3 MPa. Subsequently, the laminated article was subjected to heating treatments of 80 $^{\circ}\text{C}$ for 3 hours, 100 $^{\circ}\text{C}$ for 5 hours and 150 $^{\circ}\text{C}$ for 5 hours successively in an air oven to prepare a metal support flexible board with a copper foil for forming a circuit. A photoresist film was formed on the surface of the copper foil for forming a circuit of the obtained metal support flexible board with the copper foil for forming a circuit by a normal method and etched, and then the photoresist film was peeled off to form an opposed electrode circuit having a wiring pitch of 100 μm (conductor width 50 μm). Thereafter, the opposed electrode circuit was immersed in a fluoroboric acid-based electroless tin plating solution (manufactured by Rohm and haas company, tin plating solution (trade name), "TINPOSIT" (registered trademark) LT-34) of 70 $^{\circ}\text{C}$ for 5 minutes, and plated with tin of 0.5 μm in thickness

to prepare a metal support flexible circuit board.

[0057]

The evaluations described in the paragraphs (1) to (7) were performed using the metal support flexible board for evaluation, the metal support flexible board with a copper foil for forming a circuit and the metal support flexible circuit board, respectively prepared by the above-mentioned methods.

[0058]

(Example 2)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 1 except that, as components (A) to (D), 100 parts by weight of (A) a dimer acid polyamide resin ("TOMIDE" (registered trademark) TXC-232C, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 10.0, melt viscosity 24.0 Pa·s), 50 parts by weight of (B) a resol phenol resin (CKM 1634 manufactured by SHOWA HIGHPOLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator (2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used in preparing an adhesive layer sheet, and the evaluations described in the paragraphs (1) to (7) were performed.

[0059]

(Example 3)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 1 except that, as components (A) to (D), 100 parts by weight of (A) a dimer acid polyether amide resin ("TOMIDE" (registered trademark) PA-200, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 3, melt viscosity 40.0 Pa·s), 50 parts by weight of (B) a resol phenol resin (CKM 1634 manufactured by SHOWA HIGHPOLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator (2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used in preparing an adhesive layer sheet, and the evaluations described in the paragraphs (1) to (7) were performed.

[0060]

(Example 4)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 1 except that, as components (A) to (D), 100 parts by weight of (A) a dimer acid polyether amide resin ("TOMIDE" (registered trademark) PA-200, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 3, melt viscosity 40.0 Pa·s), 50 parts by weight of (B) a resol phenol resin (CKM 1634 manufactured by SHOWA HIGHPOLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan

Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator (2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used, and except that a mixed solvent formed by previously dispersing 300 parts by weight of (E) an alumina filler ("Admafine" (registered trademark) AO-502, average particle diameter 0.7 μ m, manufactured by Admatechs Co., Ltd.) in the mixed solvent of ethanol and toluene (mixing ratio in weight between ethanol and toluene: 1 : 4) with a sand mill so as to add (E) the alumina filler was used in preparing an adhesive layer sheet, and the evaluations described in the paragraphs (1) to (7) were performed.

[0061]

(Example 5)

(a) Preparation of Adhesive Layer Sheet

An adhesive layer sheet was prepared in the same manner as in Example 1 except that, as components (A) to (D), 100 parts by weight of (A) a dimer acid polyether amide resin ("TOMIDE" (registered trademark) PA-200, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 3, melt viscosity 40.0 Pa·s), 50 parts by weight of (B) a resol phenol resin (CKM 1634 manufactured by SHOWA HIGHPOLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator

(2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used in preparing an adhesive layer sheet.

[0062]

(b) Preparation of Metal Support Flexible Board, Metal Support Flexible Board with Sprocket Holes and Metal Support Flexible Circuit Board

The adhesive layer sheet obtained by the method described in the paragraph (a) was cut into a 30 mm width, and then one of the protective films (5) was peeled off and laminated on (2) a support (aluminum foil, thickness 50 μm , width 35 mm (manufactured by SUMIKEI ALUMINIUM FOIL co., Ltd.), coefficient of linear expansion 22.0 ppm) under the conditions of 100°C and 0.3 MPa to obtain a metal support flexible board.

[0063]

Sprocket holes (hole size 1.98 mm $\times$ 1.98 mm square, hole pitch 4.75 mm) were formed by line punching at both sides of the metal support flexible board with a die to obtain a metal support flexible board with sprocket holes.

[0064]

The protective film (5) of the metal support flexible board with sprocket holes was peeled off, and an electrolytic copper foil having a thickness of 18 μm was laminated on the metal support flexible board with sprocket holes under the conditions of 140°C and a pressure of 0.3 MPa. Subsequently, the laminated article

was subjected to heating treatments of 80°C for 3 hours, 100°C for 5 hours and 150°C for 5 hours successively in an air oven to prepare a metal support flexible board with a copper foil for forming a circuit.

[0065]

A photoresist film was formed on an entire surface of the board on the surface side of the copper foil for forming a circuit of the obtained metal support flexible board with a copper foil for forming a circuit by a normal method, and the film was exposed and developed. Next, a back material was applied onto the entire surface of the backside thereof with a brush and sprocket holes were filled with the back material. Thereafter, the metal support flexible board was etched, and then the photoresist film and the back material were peeled off to form an opposed electrode circuit having a wiring pitch of 100 μm (conductor width 50 μm). Thereafter, the opposed electrode circuit was immersed in a fluoroboric acid-based electroless tin plating solution (manufactured by Rohm and haas company, tin plating solution (trade name), "TINPOSIT" (registered trademark) LT-34) of 70°C for 5 minutes, and plated with tin of 0.5 μm in thickness to prepare a metal support flexible circuit board.

[0066]

The evaluations described in the paragraphs (1) to (7) were performed by using the metal support flexible board for evaluation, the metal support flexible board with sprocket holes,

the metal support flexible board with a copper foil for forming a circuit and the metal support flexible circuit board, which were obtained by the above-mentioned methods.

[0067]

(Example 6)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 5 except that an aluminum foil (thickness 50 μm (manufactured by SUMIKEI ALUMINIUM FOIL co., Ltd.), coefficient of linear expansion 22.0 ppm) of (2) a support, both surfaces of which were covered with a polyamide-imide resin of 3.0 μm in thickness having a Tg of 300°C, a weight average molecular weight of 11000, and a mixing ratio of an epoxy resin of 10% as (3) a support-covering layer, was used and the evaluations described in the paragraphs (1) to (7) were performed.

[0068]

(Example 7)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 5 except that an aluminum foil (thickness 50 μm (manufactured by SUMIKEI ALUMINIUM FOIL co., Ltd.), coefficient of linear expansion 22.0 ppm) of (2) a support, both surfaces of which were covered with a polyamide-imide resin of 1.5 μm in thickness having a Tg of 300°C, a weight average molecular weight of 11000, and a mixing ratio of an epoxy resin of 10% as (3) a

support-covering layer, was used and the evaluations described in the paragraphs (1) to (7) were performed.

[0069]

(Example 8)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 5 except that an aluminum foil (thickness 50 μm (manufactured by SUMIKEI ALUMINIUM FOIL co., Ltd.), coefficient of linear expansion 22.0 ppm) of (2) a support, both surfaces of which were covered with a polyamide-imide resin of 3.0 μm in thickness having a Tg of 250°C, a weight average molecular weight of 8000, and a mixing ratio of an epoxy resin of 10% as (3) a support-covering layer, was used and the evaluations described in the paragraphs (1) to (7) were performed.

[0070]

(Example 9)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 5 except that an aluminum foil (thickness 50 μm (manufactured by SUMIKEI ALUMINIUM FOIL co., Ltd.), coefficient of linear expansion 22.0 ppm) of (2) a support, both surfaces of which were covered with a polyimide resin of 3.0 μm in thickness having a Tg of 300°C and a weight average molecular weight of 12000 as (3) a support-covering layer, was used and the evaluations described in the paragraphs (1) to (7) were performed.

[0071]

(Example 10)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 6 except that 100 parts by weight of (A) a dimer acid polyamide resin ("TOMIDE" (registered trademark) PA-100, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 0, melt viscosity 180.0 Pa·s) was used as component (A) in preparing an adhesive layer sheet, and the evaluations described in the paragraphs (1) to (7) were performed.

[0072]

(Example 11)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 7 except that 100 parts by weight of (A) a dimer acid polyamide resin ("TOMIDE" (registered trademark) PA-100, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 0, melt viscosity 180.0 Pa·s) was used as component (A) in preparing an adhesive layer sheet, and the evaluations described in the paragraphs (1) to (7) were performed.

[0073]

(Example 12)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 5 except that an aluminum foil (thickness 50 μm (manufactured

by SUMIKEI ALUMINIUM FOIL co., Ltd.), coefficient of linear expansion 22.0 ppm) of (2) a support, in which the adhesive layer (1) side was covered with a polyimide resin of 3 μ m in thickness having Tg of 300°C and a weight average molecular weight of 11000 as (3) a support-covering layer, and the opposite side was roll-laminated at 30°C with a carrier tape KT-50 (manufactured by KAWAMURA SANGYO co., Ltd.) (releasable pressure-sensitive adhesive layer 20 μ m, polyethylene terephthalate film 50 μ m), in which a pressure-sensitive adhesive was formed on a polyethylene terephthalate film, was used and the evaluations described in the paragraphs (1) to (7) were performed.

[0074]

(Example 13)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 6 except that, in preparing a metal support flexible board with sprocket holes, a cross-section of the sprocket hole was electrodeposition-coated with an electrodeposition coating material ELECOAT AMG (manufactured by SIMIZU co., Ltd.), whose resin content is an epoxy resin, in a film thickness of 10 μ m, and the electrodeposition coating material was dried at 100°C for 15 minutes to form (4) a hole cross-section-covering layer, and the evaluations described in the paragraphs (1) to (7) were performed.

[0075]

(Example 14)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 13 except that, in preparing a metal support flexible board with sprocket holes, the hole cross-section-covering layer was changed to an electrodeposition coating material ELECOAT PI (manufactured by SIMIZU co., Ltd.) whose resin content is a polyimide resin, and the evaluations described in the paragraphs (1) to (7) were performed.

[0076]

(Example 15)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 1 except that, as components (A) to (D), 100 parts by weight of (A) a dimer acid polyether amide resin ("TOMIDE" (registered trademark) PA-200, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 3, melt viscosity 40.0 Pa·s), 50 parts by weight of (B) a resol phenol resin (CKM 1634 manufactured by SHOWA HIGHPOLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator (2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used in preparing an adhesive layer sheet, and except that a mixed solvent formed by previously dispersing 300 parts by weight of (E) an alumina

filler ("Admafine" (registered trademark) AO-502, average particle diameter 0.7 μm , manufactured by Admatechs Co., Ltd.) in the mixed solvent of ethanol and toluene (mixing ratio in weight between ethanol and toluene: 1 : 4) with a sand mill so as to add (E) the alumina filler was used and a SUS-316 foil (thickness 70 μm (manufactured by TOYOSEIHAKU co., ltd.), coefficient of linear expansion 18.5 ppm) was used as the support (2), and the evaluations described in the paragraphs (1) to (7) were performed.

[0077]

(Example 16)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 1 except that, as components (A) to (D), 100 parts by weight of (A) a dimer acid polyether amide resin ("TOMIDE" (registered trademark) PA-200, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 3, melt viscosity 40.0 Pa·s), 50 parts by weight of (B) a resol phenol resin (CKM 1634 manufactured by SHOWA HIGHPOLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator (2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used in preparing an adhesive layer sheet, and except that a mixed solvent formed by previously dispersing 300 parts by weight of (E) an alumina

filler ("Admafine" (registered trademark) AO-502, average particle diameter 0.7 μm , manufactured by Admatechs Co., Ltd.) in the mixed solvent of ethanol and toluene (mixing ratio in weight between ethanol and toluene: 1 : 4) with a sand mill so as to add (E) the alumina filler was used and an aluminum foil (thickness 50 μm (manufactured by SUMIKEI ALUMINIUM FOIL co., Ltd.), coefficient of linear expansion 22.0 ppm) was used as the support (2), and the evaluations described in the paragraphs (1) to (7) were performed.

[0078]

(Example 17)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 1 except that, as components (A) to (D), 100 parts by weight of (A) a dimer acid polyether amide resin ("TOMIDE" (registered trademark) PA-200, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 3, melt viscosity 40.0 Pa·s), 50 parts by weight of (B) a resol phenol resin (CKM 1634 manufactured by SHOWA HIGHPOLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator (2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used in preparing an adhesive layer sheet, and except that a mixed solvent formed by previously dispersing 300 parts by weight of (E) an aluminum

nitride filler (H, average particle diameter 1.7 μm , manufactured by TOKUYAMA CORPORATION) in the mixed solvent of ethanol and toluene (mixing ratio in weight between ethanol and toluene: 1 : 4) with a sand mill so as to add (E) the aluminum nitride filler was used, and the evaluations described in the paragraphs (1) to (7) were performed.

[0079]

(Example 18)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 1 except that, as components (A) to (D), 100 parts by weight of (A) a mixture (amine number 7.1, melt viscosity 80 Pa·s) (dimer acid polyether amide resin 1) composed of a dimer acid polyether amide resin ("TOMIDE" (registered trademark) PA-200, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 1, melt viscosity 40.0 Pa·s), a dimer acid polyamide resin ("TOMIDE" (registered trademark) PA-100, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 0, melt viscosity 180.0 Pa·s) and a dimer acid polyamide resin ("TOMIDE" (registered trademark) 535, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 50, melt viscosity 1.0 Pa·s) in proportions of 2 : 1 : 0.5 by weight, 50 parts by weight of (B) a resol phenol resin (CKM 1634 manufactured by SHOWA HIGH POLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by

weight of (D) a hardening accelerator

(2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used in preparing an adhesive layer sheet, and the evaluations described in the paragraphs (1) to (7) were performed.

(Example 19)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 1 except that, as components (A) to (D), 100 parts by weight of (A) a dimer acid polyamide resin ("Macromelt" (registered trademark) 6900, manufactured by Henkel Japan co., ltd., amine number 0, melt viscosity 10 Pa·s), 50 parts by weight of (B) a resol phenol resin (CKM 1634 manufactured by SHOWA HIGHPOLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator (2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used in preparing an adhesive layer sheet, and the evaluations described in the paragraphs (1) to (7) were performed.

[0080]

(Example 20)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 1 except that, as components (A) to (D), 100 parts by weight

of (A) a dimer acid polyamide resin ("TOMIDE" (registered trademark) 1350, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 10, melt viscosity 3.0 Pa·s), 50 parts by weight of (B) a resol phenol resin (CKM 1634 manufactured by SHOWA HIGHPOLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator (2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used in preparing an adhesive layer sheet, and the evaluations described in the paragraphs (1) to (7) were performed.

[0081]

(Example 21)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 1 except that, as components (A) to (D), 100 parts by weight of (A) a dimer acid polyamide resin ("TOMIDE" (registered trademark) PA-100, manufactured by FUJIKASEIKOGYO co., Ltd., amine number 0, melt viscosity 180.0 Pa·s), 50 parts by weight of (B) a phenol resin (CKM 1634 manufactured by SHOWA HIGHPOLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator (2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used in preparing an adhesive

layer sheet, and the evaluations described in the paragraphs (1) to (7) were performed.

[0082]

(Comparative Example 1)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 1 except that, as components (A), (C) and (D), 100 parts by weight of (A) a dimer acid polyamide resin ("Macromelt" (registered trademark) 6900, manufactured by Henkel Japan co., ltd., amine number 0, melt viscosity 10 Pa·s), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator (2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used and component (B) was not used in preparing an adhesive layer sheet, and the evaluations described in the paragraphs (1) to (7) were performed.

[0083]

(Comparative Example 2)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Example 1 except that, as components (A) to (D), 100 parts by weight of (A) an acrylonitrile polybutadiene resin ("Nipol" (registered trademark) 1043, manufactured by ZEON Corporation), 50 parts by weight of (B) a resol phenol resin (CKM 1634 manufactured

by SHOWA HIGHPOLYMER CO., LTD.), 80 parts by weight of (C) an epoxy resin ("Epikote" (registered trademark) YL980, manufactured by Japan Epoxy Resins Co., Ltd.), and 2 parts by weight of (D) a hardening accelerator (2-ethyl-4-methylimidazole (2E4MZ), manufactured by TOKYO CHEMICAL INDUSTRY CO., LTD.) were used in preparing an adhesive layer sheet, and the evaluations described in the paragraphs (1) to (7) were performed.

[0084]

(Comparative Example 3)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Comparative Example 2 except that an aluminum foil (thickness 50 μm (manufactured by SUMIKEI ALUMINIUM FOIL co., Ltd.), coefficient of linear expansion 22.0 ppm) was used as the support (2), and the evaluations described in the paragraphs (1) to (7) were performed.

[0085]

(Comparative Example 4)

A metal support flexible board and a metal support flexible circuit board were prepared in the same manner as in Comparative Example 2 except that an aluminum foil (thickness 50 μm (manufactured by SUMIKEI ALUMINIUM FOIL co., Ltd.), coefficient of linear expansion 22.0 ppm) of (2) a support, both surfaces of which were covered with a polyamide-imide resin of 3.0 μm

in thickness having a Tg of 300°C, a weight average molecular weight of 11000, and a mixing ratio of an epoxy resin of 10% as (3) a support-covering layer, was used and the evaluations described in the paragraphs (1) to (7) were performed.

[0086]

The adhesive layers (1), the supports (2), the support-covering layers (3), and the hole cross-section-covering layers (4) used in examples and comparative examples are shown in Tables 1 and 2. Further, a laminating temperature of a copper foil for forming a circuit and the results of measurement are shown in Tables 3 and 4.

[0087] [Table 1]

Table 1	(1) Adhesive layer													(2) Support			(3) Support-covering layer				(4) Hole cross-section covering layer
	Resin					Phenol resin	Hardening agent	Filler	Name	Thickness [μm]	Coefficient of thermal expansion [ppm/ $^{\circ}\text{C}$]	Resin	Thickness [μm]	Tg [$^{\circ}\text{C}$]	Mw	Resin					
	Name	Amber number	Melt viscosity [Pa·s]	Epoxy resin																	
Example 1	SUNM DE HT-100G	1	7.0	YL980	CKM 1634	2E4M Z	none	rolled copper foil	70	16	none	none	none	—							
Example 2	TXC-232C	10	24	YL980	CKM 1634	2E4M Z	none														
Example 3	PA-200	3	40	YL980	CKM 1634	2E4M Z	none														
Example 4	PA-200	3	40	YL980	CKM 1634	2E4M Z	alumina														
Example 5	PA-200	3	40	YL980	CKM 1634	2E4M Z	none	aluminum foil	50	22	polyamide resin	3.0	300	11000	none						
Example 6	PA-200	3	40	YL980	CKM 1634	2E4M Z	none														
Example 7	PA-200	3	40	YL980	CKM 1634	2E4M Z	none														
Example 8	PA-200	3	40	YL980	CKM 1634	2E4M Z	none														
Example 9	PA-200	3	40	YL980	CKM 1634	2E4M Z	none	polyimide resin	3.0	250	8000	none	none	none							
Example 10	PA-100	0	180	YL980	CKM 1634	2E4M Z	none														
Example 11	PA-100	0	180	YL980	CKM 1634	2E4M Z	none														
Example 12	PA-200	3	40	YL980	CKM 1634	2E4M Z	none														
Example 13	PA-200	3	40	YL980	CKM 1634	2E4M Z	none	polyimide resin	3.0	300	11000	epoxy resin	polyimide resin								
Example 14	PA-200	3	40	YL980	CKM 1634	2E4M Z	none														

[0088] [Table 2]

[Table 2]

	(1) Adhesive layer										(2) Support			(3) Support-covering layer			(4) Hob cross-section covering layer	
	Resin		Amine number	Melt viscosity [Pa·s]	Epoxy resin	Phenol resin	Hardening agent	Filler	Name	Thickness [μm]	Coefficient of thermal expansion	Resin	Thickness [μm]	Tg [°C]	Mw	Resin		
	Name																	
Example 15	PA-200	dimercapolyether amine resin	3	40	YL980	CKM 1634	2E4M Z	alumina	SUS316	70	18.5	none	none	—	—	—		
Example 16	PA-200	dimercapolyether amine resin	3	40	YL980	CKM 1634	2E4M Z	alumina	aluminum foil	50	22	none	none	—	—	—		
Example 17	PA-200	dimercapolyether amine resin	3	40	YL980	CKM 1634	2E4M Z	aluminum nitride				none	none	—	—	—		
Example 18	dimercapolyether amine resin	dimercapolyether amine resin	7.1	80	YL980	CKM 1634	2E4M Z	none				none	none	—	—	—		
Example 19	Macromelt 6900	dimercapolyether amine resin	0	10	YL980	CKM 1634	2E4M Z	none	rolled copper foil	70	16	none	none	—	—	—		
Example 20	TOMDE 1350	dimercapolyether amine resin	10	3.0	YL980	CKM 1634	2E4M Z	none				none	none	—	—	—		
Example 21	PA-100	dimercapolyether amine resin	0	180	YL980	CKM 1634	2E4M Z	none				none	none	—	—	—		
Comparative Example 1	Macromelt 6900	dimercapolyether amine resin	0	10	YL980	—	2E4M Z	none	rolled copper foil	70	16	none	none	—	—	—		
Comparative Example 2	Npol1043	acrylonitrile polybutadiene resin	—	1	YL980	CKM 1634	2E4M Z	none				none	none	—	—	—		
Comparative Example 3	Npol1043	acrylonitrile polybutadiene resin	—	1	YL980	CKM 1634	2E4M Z	none	aluminum foil	50	22	none	none	—	—	—		
Comparative Example 4	Npol1043	acrylonitrile polybutadiene resin	—	1	YL980	CKM 1634	2E4M Z	none	aluminum foil	50	22	polyamide-imide resin	3.0	300	11000	—		

[0089] [Table 3]

[Table 3]

	Laminating temperature of copper foil for forming circuit [°C]	Insulation reliability	Amount of curl [mm]	Foaming	Pressure welding resistance	Punching properties			Chemical resistance		Adhesion Force [N/cm]
		Endurance time of insulation [h]		○: none △: 1 to 10 foams ×: 50 μm or more, or 11 foams or more	Sinking amount of wiring [μm]	Length of burr [μm]	Length of chip [μm]	Peeling	Metal support flexible board	Metal support flexible board with sprocket holes	
Example 1	90	280	1.0	△	2.0	8	0	none	rank C	—	7
Example 2	110	350	7.0	○	0.5	18	11	none	rank C	—	7
Example 3	110	390	0.0	○	1.5	2	3	none	rank C	—	7
Example 4	110	320	1.0	○	0.8	2	3	none	rank C	—	7
Example 5	110	390	0.0	○	1.5	2	3	none	rank C	rank C	6
Example 6	110	450	0.0	○	0.5	2	0	none	rank A	rank B	11
Example 7	110	420	0.0	○	0.5	2	1	none	rank B	rank B	11
Example 8	110	450	0.0	○	1.5	2	2	none	rank B	rank B	10
Example 9	110	450	2.0	○	0.5	2	2	none	rank A	rank B	6
Example 10	140	300	0.0	○	2.0	12	0	none	rank A	rank B	10
Example 11	140	275	0.0	○	2.0	10	0	none	rank B	rank B	11
Example 12	110	450	0.0	○	0.5	2	1	none	rank A	rank B	11
Example 13	110	450	0.0	○	0.5	2	0	none	rank A	rank A	11
Example 14	110	450	0.0	○	0.5	2	0	none	rank A	rank A	11

[0090] [Table 4]

[Table 4]

	Laminating temperature of copper foil for forming circuit	Insulation reliability	Amount of curl	Foaming	Pressure welding resistance	Punching properties			Chemical resistance		Adhesion Force [N/cm]
						Length of burr [μm]	Length of chip [μm]	Peeing	Metal support flexible board	Metal support flexible board with sprocket holes	
Example 15	110	Endurance time of insulation test	1.0	○: none △: 1 to 10 foams ×: 50 μm or more, or 11 foams or more	0.8	2	3	none	rank C	—	6
Example 16	110	300	1.0	○	0.8	2	3	none	rank C	—	6
Example 17	110	250	1.5	○	0.8	2	3	none	rank C	—	7
Example 18	120	450	3.0	○	0.5	2	5	none	rank C	—	7
Example 19	100	270	0.5	○	3.0	11	10	none	rank C	—	7
Example 20	90	330	7.0	△	0.5	0	18	none	rank C	—	7
Example 21	140	250	0.5	△	3.0	19	0	none	rank C	—	7
Comparative Example 1	100	90	0.0	○	6.0	21	15	none	rank C	—	7
Comparative Example 2	140	35	11.0	×	7.0	42	25	occurred	rank F	—	5
Comparative Example 3	140	35	12.0	×	7.0	35	20	occurred	rank F	—	4
Comparative Example 4	140	35	12.0	×	7.0	35	20	occurred	rank C	—	5

INDUSTRIAL APPLICABILITY

[0091]

In accordance with the present invention, since a metal support flexible board has excellent wire bonding properties and low curling properties while maintaining excellent insulating properties and punching properties, it becomes possible to facilitate packaging scheme and heat dissipation scheme. Electronic parts using the metal support flexible board of the present invention have chemical resistance necessary for circuit processing and insulating properties which enable high-voltage driving in a circuit of a metal support board, can be easily subjected to a reel-to-reel process and a punching process and is easy to form a flying lead, and therefore the electronic parts enable a more simple heat dissipation scheme at lower cost than conventional electronic parts.

CLAIMS

1. A metal support flexible board comprising (1) an adhesive layer and (2) a support, wherein the support (2) is composed of a metal foil, and the adhesive layer (1) contains (A) a polyamide resin containing a dimer acid residue and (B) a phenol resin.

2. The metal support flexible board according to claim 1, wherein (3) a support-covering layer is formed on the adhesive layer (1) side of the support (2) and/or the opposite side thereof.

3. The metal support flexible board according to claim 2, wherein the support-covering layer (3) has releasability from the support (2).

4. The metal support flexible board according to claim 2 or 3, wherein the thickness of the support-covering layer (3) is 2 μm or more and 100 μm or less.

5. The metal support flexible board according to any one of claims 2 to 4, wherein the support-covering layer (3) contains a polyamide-imide resin.

6. The metal support flexible board according to any one

of claims 1 to 5, wherein an amine number of the polyamide resin (A) containing a dimer acid residue is 0.5 to 10.

7. The metal support flexible board according to any one of claims 1 to 6, wherein the support (2) is one selected from among a copper foil, a stainless steel foil, an aluminum foil and a nickel foil.

8. A metal support carrier tape for tape automated bonding using the metal support flexible board according to any one of claims 1 to 7.

9. A metal support flexible circuit board for mounting an LED using the metal support flexible board according to any one of claims 1 to 7.

10. A copper foil-laminated metal support flexible circuit board for forming a circuit using the metal support flexible board according to any one of claims 1 to 7, wherein a circuit formed by a metal layer for forming a circuit has a flying lead structure.