

In order to solve the aforementioned problem, the present inventors made extensive and intensive investigations. As the result, it has been found that the foregoing problem can be solved by the present invention as mentioned below. Specifically, the present invention provides the following [1] to [6].

[1] A multilayered transmission line plate including a pair of ground layers, a differential wiring disposed between a one-sided ground layer of the pair of ground layers and the other ground layer, an insulating layer (X) disposed between the differential wiring and the one-sided ground layer, and an insulating layer (Y) disposed between the differential wiring and the other ground layer, wherein the insulating layer (X) has a layer containing a resin and not containing a glass cloth; the insulating layer (X) or the insulating layer (Y) has a layer containing a glass cloth and a resin; and the thickness of the insulating layer (X) is equal to or less than the thickness of the insulating layer (Y).

[2] The multilayered transmission line plate as set forth above in [1], including a pair of ground layers, a differential wiring disposed between a one-sided ground layer of the pair of ground layers and the other ground layer, an insulating layer (1-I), as the insulating layer (X), between the differential wiring and the one-sided ground layer, and an insulating layer (1-II), as the insulating layer (Y), between the differential wiring and the other ground layer, wherein the insulating layer (1-I) is a layer containing a resin and not containing a glass cloth; the insulating layer (1-II) is a layer containing a glass cloth and a resin; and the thickness of the insulating layer (1-I) is equal to or less than the thickness of the insulating layer (1-II).

[3] The multilayered transmission line plate as set forth above in [1], including a pair of ground layers, a differential wiring disposed between a one-sided ground layer of the pair of ground layers and the other ground layer, an insulating layer (2-I), as the insulating layer (Y), between the differential wiring and the other ground layer, and an insulating layer (2-II), as the insulating layer (X), between the differential wiring and the one-sided ground layer, wherein the insulating layer (2-II) has an insulating layer (2-IIA) and an insulating layer (2-IIB) laminated on the insulating layer (2-IIA); the insulating layer (2-I) is a layer containing a glass cloth and a resin; the insulating layer (2-IIA) is a layer containing a resin and not containing a glass cloth; the insulating layer (2-IIB) is a layer containing a glass cloth and a resin; and the thickness of the insulating layer (2-II) is equal to or less than the thickness of the insulating layer (2-I).

(perturbation method cavity resonator: CP531, manufactured by Kanto Electronic Application and Development Inc.).

[0015]

[Multilayered transmission line plate]

The multilayered transmission line plate according to the present embodiment is, for example, used for high-speed digital transmission by a Gbps-order differential transmission system.

The multilayered transmission line plate of the present invention is a multilayered transmission line plate including a pair of ground layers, a differential wiring disposed between a one-sided ground layer of the pair of ground layers and the other ground layer, an insulating layer (X) disposed between the differential wiring and the one-sided ground layer, and an insulating layer (Y) disposed between the differential wiring and the other ground layer, wherein the insulating layer (X) has a layer containing a resin and not containing a glass cloth; the insulating layer (X) or the insulating layer (Y) has a layer containing a glass cloth and a resin; and the thickness of the insulating layer (X) is equal to or less than the thickness of the insulating layer (Y). The insulating layer (X) or the insulating layer (Y) is not limited to a single layer and may be of a structure of plural layers having plural insulating materials.

It may be considered that in view of the fact that in the multilayered transmission line plate of the present invention, a material not containing a glass cloth is used for a part of the insulating layers constituted of materials containing a glass cloth in a conventional multilayered transmission line plate, the heterogeneity of the dielectric constant is lightened, whereby the skew can be reduced.

[0016]

(Ground layer)

Although the ground layer is not particularly limited, materials which are applied for a conductive layer of a conventional printed wiring board or the like (for example, a metal foil, etc.) can be applied.

As the metal foil, for example, a copper foil, a nickel foil, an aluminum foil, and so on can be applied, and from the viewpoint of handling properties and costs, a copper foil is preferred. From the viewpoints of rust preventing properties, chemical resistance, and heat resistance, in the metal foil, a barrier layer made of nickel, tin, zinc, chromium, molybdenum, cobalt, etc. may also be formed. In

processing, thereby forming the insulating layer (1-II) 32 in which the differential wiring 91 is disposed on a one-sided surface thereof, and the ground layer 21 is disposed on the other surface, and subsequently, a resin film for forming the insulating layer (1-I) 31 and a copper foil constituting the ground layer 11 are laminated in this order on the surface on which the differential wiring 91 is formed, followed by molding.

[0079]

In the aforementioned multilayered transmission line plate according to the first embodiment of the present invention, a configuration in which the insulating layer (1-I) 31 and the insulating layer (1-II) 32 shown in Fig. 3 are made upside down can be formed in the same manner as mentioned above and adopted.

Next, the multilayered transmission line plate according to the second embodiment of the present invention is described.

[0080]

<Multilayered transmission line plate according to the second embodiment>

Fig. 4 is a schematic cross-sectional view showing a multilayered transmission line plate 2A according to the second embodiment of the present invention.

As shown in Fig. 4, the multilayered transmission line plate 2A according to the second embodiment of the present invention is a multilayered transmission line plate which includes a pair of ground layers 12 and 22; a differential wiring 92 disposed between the one-sided ground layer 22 of the pair of the ground layers 12 and 22 and the other ground layer 12; an insulating layer (2-I) 41 disposed between the differential wiring 92 and the other ground layer 12; and an insulating layer (2-II) 42 disposed between the differential wiring 92 and the one-sided ground layer 22, and in which the insulating layer (2-II) 42 has an insulating layer (2-IIA) 42a and an insulating layer (2-IIB) 42b laminated on the insulating layer (2-IIA) 42a; the insulating layer (2-I) 41 contains a glass cloth and a resin; the insulating layer (2-IIA) 42a contains a resin and does not contain a glass cloth; the insulating layer (2-IIB) 42b contains a glass cloth and a resin; and the thickness of the insulating layer (2-II) 42 is equal to or less than the thickness of the insulating layer (2-I) 41.

[0081]

Although Fig. 4 shows an example in which the insulating layer (2-IIB) 42b is disposed between the differential wiring 92 and the insulating layer (2-IIA) 42a,

CLAIMS

[Claim 1]

A multilayered transmission line plate comprising:
a pair of ground layers,
a differential wiring disposed between a one-sided ground layer of the pair of ground layers and the other ground layer,
an insulating layer (X) disposed between the differential wiring and the one-sided ground layer,
an insulating layer (Y) disposed between the differential wiring and the other ground layer,
wherein

the insulating layer (X) has a layer containing a resin and not containing a glass cloth;

the insulating layer (X) or the insulating layer (Y) has a layer containing a glass cloth and a resin;

the thickness of the insulating layer (X) is equal to or less than the thickness of the insulating layer (Y); and

the layer containing a glass cloth and a resin is a layer containing a glass cloth and a resin composition, and a difference in dielectric constant between the glass cloth and the resin composition is 1.0 or less.

[Claim 2]

The multilayered transmission line plate according to claim 1, comprising:
a pair of ground layers,
a differential wiring disposed between a one-sided ground layer of the pair of ground layers and the other ground layer,
an insulating layer (1-I), as the insulating layer (X), between the

differential wiring and the one-sided ground layer, and

an insulating layer (1-II), as the insulating layer (Y), between the differential wiring and the other ground layer,

wherein

the insulating layer (1-I) is a layer containing a resin and not containing a glass cloth;

the insulating layer (1-II) is a layer containing a glass cloth and a resin;
and

the thickness of the insulating layer (1-I) is equal to or less than the thickness of the insulating layer (1-II).

[Claim 3]

The multilayered transmission line plate according to claim 1, comprising:

a pair of ground layers,

a differential wiring disposed between a one-sided ground layer of the pair of ground layers and the other ground layer,

an insulating layer (2-I), as the insulating layer (Y), between the differential wiring and the other ground layer, and

an insulating layer (2-II), as the insulating layer (X), between the differential wiring and the one-sided ground layer,

wherein

the insulating layer (2-II) comprises an insulating layer (2-IIA) and an insulating layer (2-IIB) laminated on the insulating layer (2-IIA);

the insulating layer (2-I) is a layer containing a glass cloth and a resin;

the insulating layer (2-IIA) is a layer containing a resin and not containing a glass cloth;

the insulating layer (2-IIB) is a layer containing a glass cloth and a resin;
and

the thickness of the insulating layer (2-II) is equal to or less than the thickness of the insulating layer (2-I).

[Claim 4]

The multilayered transmission line plate according to any one of claims 1 to 3, wherein the dielectric constant of the glass cloth is 5.0 or less.

[Claim 5]

A multilayered transmission line plate comprising:

a pair of ground layers,

a differential wiring disposed between a one-sided ground layer of the pair of ground layers and the other ground layer,

an insulating layer (3-I) disposed between the differential wiring and the one-sided ground layer, and

an insulating layer (3-II) disposed between the differential wiring and the other ground layer,

wherein

the insulating layer (3-II) comprises an insulating layer (3-IIA) and an insulating layer (3-IIB) laminated on the insulating layer (3-IIA);

the insulating layer (3-I) is a layer containing a resin and not containing a glass cloth;

the insulating layer (3-IIA) is a layer containing a resin and not containing a glass cloth;

the insulating layer (3-IIB) is a layer containing a glass cloth and a resin;
and

wherein the layer containing a glass cloth and a resin is a layer containing a glass cloth and a resin composition, and a difference in dielectric constant between the glass cloth and the resin composition is 1.0 or less.