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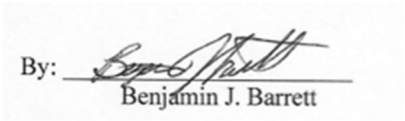
I, Benjamin Barrett, declare:

I am a professional translator specializing in translating Japanese to English.

I have more than 25 years of experience translating thousands of technical, legal, and business documents from Japanese to English.

I certify that the following Japanese to English translation of the corresponding source text is a true, correct, and complete translation to the best of my knowledge and ability.

I hereby certify under penalty of perjury that the foregoing is true and correct. Executed this 6th day of November 2021 in Skagit County of the State of Washington.



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(71) Applicant: 000237721
FDK CORP
5-36-11 Shinbashi, Minato-ku, Tokyo
(74) *Agent, attorney, or firm:* 100096862
Chiharu Shimizu, patent attorney
(72) Inventor: Yuji Goto
% FDK CORP
5-36-11 Shinbashi, Minato-ku, Tokyo
(72) Inventor: Da Ro
% FDK CORP
5-36-11 Shinbashi, Minato-ku, Tokyo
(72) Inventor: Toshitaka Hashimoto
% FDK CORP
5-36-11 Shinbashi, Minato-ku, Tokyo

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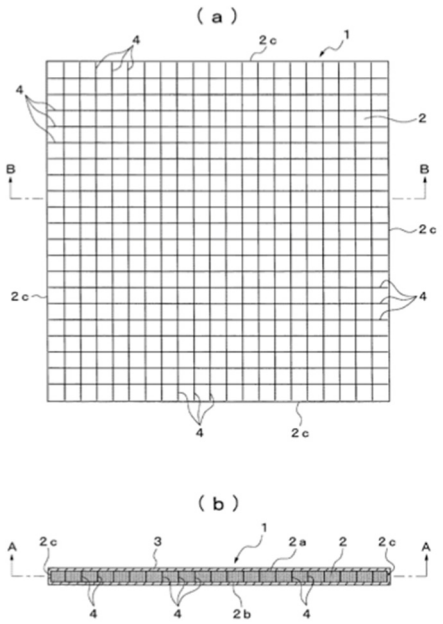
(54) (TITLE) **FERRITE PLATE AND MANUFACTURING METHOD THEREOF**

(57) **(ABSTRACT)**

(**PROBLEM**) To provide a ferrite plate with a desired flexibility and which maximally utilizes the surface area of a sintered ferrite sheet to obtain excellent characteristics.]

(**MEANS TO SOLVE THE PROBLEM**) A coating layer 3 comprising a flexible synthetic resin is formed on the front and back surfaces 2a, 2b and the side faces 2c of a thin plate-like sintered ferrite sheet 2, and the sintered ferrite sheet 2 is divided into small pieces along a plurality of cutting lines 11, 12 penetrating the front and back surfaces of the sintered ferrite sheet 2.

(**SELECTED DRAWING**) FIG. 1



(**CLAIMS**)

(**CLAIM 1**)

A ferrite plate characterized in that a coating layer comprising a flexible synthetic resin is formed on the front, back, and side surfaces of a thin board-like sintered ferrite sheet, and the aforementioned sintered ferrite sheet is divided into small pieces along a plurality of cutting lines penetrating the front and back surfaces of the aforementioned sintered ferrite sheet.

(**CLAIM 2**)

The ferrite plate set forth in claim 1 characterized in that the aforementioned coating layer is formed with an ultraviolet curing resin or a thermosetting resin having a hardness (Shore A) of 45 to 90.

(**CLAIM 3**)

A method for manufacturing a ferrite plate characterized in that discontinuous cutting lines are formed on a thin board-like ferrite green sheet, penetrating the front and back surfaces thereof, then said ferrite green sheet is sintered to form a sintered ferrite sheet, a flexible synthetic resin is applied to the front, back, and side surfaces of said sintered ferrite sheet, next said synthetic resin is cured, and then a weight is applied to the aforementioned sintered ferrite sheet in an out-of-plane direction, dividing said sintered ferrite sheet along the aforementioned cutting lines.

(**CLAIM 4**)

The method for manufacturing a ferrite plate set forth in claim 3 characterized in that an ultraviolet curing resin or a thermosetting resin with a hardness (Shore A) of 45 to 90 is applied as the aforementioned synthetic resin and then cured with ultraviolet ray irradiation or heat.

(**CLAIM 5**)

The method for manufacturing a ferrite plate set forth in claim 3 or 4 characterized in that, as the aforementioned cutting lines, a plurality of discontinuous perforation-like first cutting lines are formed in a first direction of the aforementioned ferrite green sheet with intervals in the direction orthogonal to the aforementioned first direction, and a plurality of discontinuous perforation-like second cutting lines are formed in a second direction orthogonal to the aforementioned first direction with intervals in the direction orthogonal to the aforementioned second direction.

(**CLAIM 6**)

The method for manufacturing a ferrite plate set forth in claim 5 characterized in that the aforementioned first and second cutting lines are formed intersecting each other at the aforementioned penetration portions.

(DETAILED DESCRIPTION OF THE INVENTION)

(TECHNICAL FIELD)

(0001)

The present invention relates to a ferrite plate affixed to an electronic device or the like as an EMI measure, a heat dissipation measure or the like for said electronic device.

(BACKGROUND ART)

(0002)

In recent years, plates using a sintered ferrite sheet with high magnetic permeability have been adopted in structures affixed to an RF-ID or electronic device to suppress RF-ID metal interference, and as EMI measures and heat dissipation measures for electronic devices.

(0003)

However, while the sintered ferrite sheets used in this type of plate function to counter high noise due to the increased magnetic permeability, there is a drawback in that the sintered ferrite sheets are brittle against mechanical stress and shock due to the low elastic modulus. Therefore, when a thin plate-like sintered ferrite sheet is affixed as is to the aforementioned electronic device with an irregular surface, irregular fragmentation and cracking occur, inviting degradation of the magnetic characteristics (magnetic permeability) and resulting in the danger of not obtaining the desired noise measure functionality and the like.

(0004)

A method has been conventionally used for affixing the aforementioned sintered ferrite sheet to the aforementioned electronic device or the like in which the sintered ferrite sheet is divided into regular small pieces in advance with overall enhanced flexibility. As seen in the below-mentioned Patent Document 1, for example, during the manufacture of the sintered ferrite sheet with this method, a groove with a prescribed depth is made (half-cut) in the surface, a protection film or an adhesive layer is formed on the surface of said sintered ferrite sheet so that the small pieces thereof do not separate or fall after division, and then the division is carried out along the aforementioned groove to form the aforementioned flexible ferrite plate.

(0005) Methods adopted for cutting the groove in the aforementioned sintered ferrite sheet include cutting the ferrite sheet with a dicing saw or the like after sintering and cutting a recessed groove with a cutting machine or the like in a ferrite green sheet before sintering and then sintering.

(0006) FIG. 5 shows a conventional ferrite plate obtained in this manner. In a ferrite plate 50, a sintered ferrite sheet 52 formed with grooves 51 is covered on the front and back surfaces with protection films 53 and 54, outer peripheral parts 53a and 54a are joined by heat sealing, bonding, or the like, and then a weight is applied on the sintered ferrite sheet 52 in an out-of-plane direction to divide, along the grooves 51, the aforementioned sintered sheet 52 into small pieces.

(**PRIOR ART DOCUMENTS**)

(**PATENT DOCUMENTS**)

(0007)

(**PATENT DOCUMENT 1**) JP 4277596

(SUMMARY OF THE INVENTION)

(**PROBLEM THE INVENTION IS TO SOLVE**)

(0008)

However, when affixing the aforementioned conventional ferrite plate 50 to an electronic device or the like, the outer periphery parts 53a and 54a must be joined securely to the protection films 53 and 54 so that said small pieces do not fall or the like.

(0009)

Therefore, the surface area of the sintered ferrite sheet 52 to the total surface area of the ferrite plate 50 is necessarily smaller by the area corresponding to a width L of the outer periphery parts 53a and 54a of the protection films 53 and 54, and therefore, even if a plate with a high magnetic permeability is used as the sintered ferrite sheet 52, there is the problem that the characteristics degrade with the reduction in the aforementioned surface area.

(0010)

The present invention was devised taking these circumstances into account and has the problem of providing a ferrite plate with a desired flexibility and which maximally utilizes the surface area of a sintered ferrite sheet to obtain excellent characteristics.

(**MEANS TO SOLVE THE PROBLEM**)

(0011)

In order to solve the aforementioned problem, the ferrite plate according to the invention set forth in claim 1 is characterized in that a coating layer comprising a flexible synthetic resin is formed on the front, back, and side surfaces of a thin board-like sintered ferrite sheet, and the aforementioned sintered ferrite sheet is divided into small pieces along a plurality of cutting lines penetrating the front and back surfaces of the aforementioned sintered ferrite sheet.

(0012)

The invention set forth in claim 2 is characterized in that in the invention set forth in claim 1, the aforementioned coating layer is formed with an ultraviolet curing resin or a thermosetting resin having a hardness (Shore A) of 45 to 90.

(0013)

The method for manufacturing a ferrite plate according to the invention set forth in claim 3 is characterized in that discontinuous cutting lines are formed on a thin board-like ferrite green sheet, penetrating the front and back surfaces thereof, then said ferrite green sheet is sintered to form a sintered ferrite sheet, a flexible synthetic resin is applied to the front, back, and side surfaces of said sintered ferrite sheet, next said synthetic resin is cured, and then a weight is applied to the aforementioned sintered ferrite sheet in an out-of-plane direction, dividing said sintered ferrite sheet along the aforementioned cutting lines.

(0014)

The invention set forth in claim 4 is characterized in that in the invention set forth in claim 3, an ultraviolet curing resin or a thermosetting resin with a hardness (Shore A) of 45 to 90 is applied as the aforementioned synthetic resin and then cured with ultraviolet ray irradiation or heat.

(0015)

The invention set forth in claim 5 is characterized in that in the invention set forth in claim 3 or 4, as the aforementioned cutting lines, a plurality of discontinuous perforation-like first cutting lines are formed in a first direction of the aforementioned ferrite green sheet with intervals in the direction orthogonal to the aforementioned first direction, and a plurality of discontinuous perforation-like second cutting lines are formed in a second direction orthogonal to the aforementioned first direction with intervals in the direction orthogonal to the aforementioned second direction.

(0016)

The invention set forth in claim 6 is characterized in that in the invention set forth in claim 5, the aforementioned first and second cutting lines are formed intersecting each other at the aforementioned penetration portions.

(EFFECT OF THE INVENTION)

(0017)

According to the ferrite plate set forth in claims 1 and 2 and the ferrite plate obtained by the method for manufacturing a ferrite plate set forth in claims 3 to 6, the front, back, and sides of a sintered ferrite sheet are covered with a coating layer comprising a flexible synthetic resin, and therefore no synthetic resin portion fails to contribute to the performance in the outer peripheral portion as conventionally occurred. Therefore the surface area of the sintered ferrite sheet is maximally used to obtain excellent characteristics.

(0018)

Because the aforementioned coating layer covers the entirety of the aforementioned sintered ferrite sheet from the top and bottom surfaces to the side surfaces, even if the aforementioned ferrite plate is affixed to an electronic device or the like, the small pieces of the sintered ferrite sheet after division are reliably prevented from separating and falling.

(0019)

The aforementioned coating layer is suitable for formation with a ultraviolet curing resin or a thermosetting resin with a hardness of 45–90 (Shore A) as in the invention set forth in claim 2 or 4. The thickness of a general protection film is conventional around 50 μm. Accordingly, the thickness of the coating layer in the present invention is equivalent or no greater than 50 μm. When using this, if the hardness exceeds 90 and the layer after curing is thin, there is the danger of cracking appearing due to the inability to withstand the stress when the sintered ferrite sheet is divided and split into pieces, and if the aforementioned hardness is less than 45, then while there is no problem when the sintered ferrite sheet is divided and split into pieces, there is a danger that the operability will degrade when setting said ferrite plate to an electronic device or the like due to excessive flexibility, which is not desirable.

(0020)

When conventionally forming a cut line for dividing the aforementioned sintered ferrite sheet into small pieces, a method is generally adopted such as in which a groove is cut (half-cut) to a prescribed depth with a cutting machine or the like in the surface of the ferrite green sheet before sintering, but if the ferrite green sheet becomes thin, there is the problem that cutting the groove to high precision is difficult, and when cutting a ferrite green sheet with a different thickness, there is the problem that the settings of the cutting machine must be changed according to said thickness, which takes extra time.

(0021)

As in the invention set forth in claim 5, by forming the discontinuous perforation-like first cutting lines in a first direction of the aforementioned ferrite green sheet at intervals in the direction orthogonal to the aforementioned first direction and forming the discontinuous perforation-like second cutting lines in a second direction orthogonal to the aforementioned first direction with intervals in the direction orthogonal to the second direction, processing is easy even if the aforementioned sintered ferrite sheet has some partial thickness differences or is no greater than 100 μm in thickness, and after the aforementioned coating layer is formed, a weight can be applied in an out-of-plane direction to divide the sintered ferrite sheet into small pieces along the aforementioned first and second cutting lines.

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