DESCRIPTION

Invention Title: MAGNETIC FIELD SHIELDING SHEET FOR WIRELESS CHARGER, METHOD FOR MANUFACTURING SAME, AND RECEIVING APPARATUS FOR WIRELESS CHARGER USING THE SHEET

【Technical Field】

[1]

The present invention relates to a magnetic field shielding sheet for a wireless charger, a method for manufacturing the same, and a receiving apparatus for a wireless charger using the sheet, and more particularly, to a magnetic field shielding sheet for a wireless charger, which prevents an alternating-current magnetic field, which is generated when a charger function is implemented in a portable terminal or the like in a contactless (wireless) manner, from affecting a main body of a portable terminal or the like, thereby improving efficiency of power transmission, a method for manufacturing the same, and a receiving apparatus for a wireless charger using the sheet.

【Background Art】

[2]

A charging method for a secondary battery mounted in an electronic device such as a portable terminal or a video camera includes two types of charging methods, that is, a contact-type charging method and a contactless charging method. The contact-type charging method is a method in which charging is performed by directly bringing an electrode of a power receiving apparatus into direct contact with an electrode of a power feeding apparatus.

[3]

The contact-type charging method has been generally used in a wide range of applications due to its simple apparatus structure. However, as a weight of various electronic devices is reduced with the miniaturization and weight reduction of electronic devices, a contact pressure between electrodes of the power receiving apparatus and the power feeding apparatus is insufficient, causing problems such as charging failure (charging error). In addition, since the secondary battery is weak to heat, it is necessary to prevent the temperature rising of the battery, and attention has to be paid to a circuit design not to cause overdischarge and overcharge. In order to cope with these problems, the contactless charging method has recently been studied.

[4]

The contactless charging method is a charging method using electromagnetic induction by installing coils on both sides of a power receiving apparatus and a power feeding apparatus.

[5]

The miniaturization of a contactless charger has been realized by using a ferrite core as a magnetic core and winding a coil around the ferrite core. In addition, in order to reduce the miniaturization and slimness, technology in which a resin substrate is formed by mixing ferrite powder and amorphous powder and a coil or the like is mounted on the resin substrate has been proposed. However, when ferrite is processed thinly, the magnetic field shielding sheet is brittle and has poor impact resistance, and thus there is a problem in that a defect occurs in a power receiving system due to a drop or collision of a device.

[6]

In addition, in order to reduce a thickness of a power receiving part in response to the reduction in the thickness of electronic devices, a flat coil formed by printing a metal powder paste on the coil has been employed. A structure for strengthening coupling using a flat coil and a magnetic sheet has been proposed. In these proposed structures, a magnetic material (magnetic sheet) is used as a core material for strengthening the coupling between primary and secondary coils.

[7]

Meanwhile, when a power transmission speed increases, not only the coupling between adjacent transformers, but also defects due to heat generation in the

surrounding parts are likely to occur. That is, when the flat coil is used, a magnetic flux passing through the flat coil is connected to a substrate inside the device, and thus, heat is generated in the inside of the device due to an eddy current generated by electromagnetic induction. As a result, there are problems such as large power may not be transmitted and a long charging time is taken.

[8]

In order to cope with these problems, a magnetic material (magnetic sheet) has also been used as a shielding member for a back surface. In order to obtain a sufficient shielding effect, the magnetic material (magnetic sheet) has high permeability, and the larger the area and thickness, the more effective the shielding effect may be obtained.

[9]

It is common to use a magnetic material, such as amorphous ribbon, ferrite, or a polymer sheet containing magnetic powder, as the magnetic field shielding sheet. A magnetic field focusing effect of shielding a magnetic field and improving performance of additional functions is good in the order of the amorphous ribbon, the ferrite, and the polymer sheet containing magnetic powder with high permeability.

[10]

The power receiving apparatus of the conventional contactless charging system has a magnetic material (magnetic sheet) with high permeability and a large volume, which is disposed on a side opposite to a primary coil side, that is, on a side of a secondary coil, in order to strengthen the coupling for improvement in power transmission efficiency and to improve the shielding performance for suppress of heat generation. According to this disposition, a fluctuation in inductance of the primary coil becomes large, and there arises a problem that operation conditions of a resonance circuit deviate from the resonant conditions that may exert a sufficient effect depending on a relative positional relationship between the magnetic material and the primary coil.

[11]

To solve the above-described problems, Korean Patent Laid-Open Publication No. 10-2010-31139 (Patent Document 1) discloses technology in which, by providing a power receiving apparatus capable of improving resonance and suppressing heat generation, an electronic device and a power receiving system using the power receiving apparatus can increase transmission power and shorten a charging time.

[12]

That is, Korean Patent Laid-Open Publication No. 10-2010-31139 discloses technology of, by arranging a composite magnetic material including a plurality of magnetic sheets (magnetic ribbons) in at least one location between a spiral coil (spiral coil, secondary coil on a power receiving side) and a secondary battery and between a rectifier and the spiral coil, preventing a magnetic flux generated from a spiral coil (primary coil) on a power feeding side from interlinking with a circuit board, a secondary battery, and the like, and controlling the amount of change in inductance of the primary coil by presence or absence of the secondary coil while suppressing noise and heat generation due to induced electromotive force (electromagnetic induction) to effectively control oscillation by improving a resonance of a resonance circuit formed of the primary coil.

[13]

The composite magnetic material sets a first magnetoresistance of a first magnetic sheet adjacent to the spiral coil to be less than or equal to 60, a second magnetoresistance of a second magnetic sheet laminated on the first magnetic sheet to be greater than or equal to 100, and values (second magnetoresistance/first magnetoresistance) to be greater than or equal to 1.0.

[14]

The first magnetic sheet is manufactured by adhering a polycarbonate resin onto both sides of the first amorphous ribbon using an adhesive layer, respectively, the second magnetic sheet is manufactured by adhering the polycarbonate resin onto both sides of the second amorphous ribbon with a relatively higher relative permeability using the adhesive layer, and then, the first magnetic sheet and the second magnetic

sheet are integrally adhered through the adhesive layer.

[15]

Meanwhile, in the case of the ferrite sheet or the polymer sheet containing magnetic powder, the permeability is slightly lower than that of the amorphous ribbon. In order to improve the performance of such low permeability, it is difficult to respond to the trend of thinner terminals because it is thicker than the amorphous ribbon, which is a thin plate with a thickness of several tens of μm.

[16]

In addition, in the case of the amorphous ribbon with high permeability, since the ribbon itself is a thin metal plate, there is no burden on the thickness, but, when an alternating-current magnetic field according to a frequency of 100 kHz used for power transmission is applied to the amorphous ribbon, the application function may be deteriorated due to the effect of eddy current on the ribbon surface, or deterioration in efficiency and heat generation may occur during wireless charging occur.

[17]

In the case of Co- or Fe-based amorphous ribbon, a surface resistance may be slightly increased through heat treatment, but when processing such as flake which reduces a ribbon surface area to further reduce the effect of the eddy currents is performed, the permeability drops significantly and thus, a function as a shielding sheet is significantly reduced.

[18]

In addition, in the case of the wireless charger, in order to maximize the efficiency of the charger, there are many structures employing permanent magnets to help align with a receiver in a power transmission transmitter. As a result, due to the direct current magnetic field of the permanent magnet, the thin shielding sheet has a magnetization (saturation) phenomenon, resulting in poor performance or a sharp drop in power transmission efficiency.

[19]

Accordingly, in the prior art, in order to exhibit shielding properties without being affected by the permanent magnets, the thickness of the shielding sheet needs to be very thick (0.5 T or more) to maintain high power transmission efficiency, which is a major obstacle to slimming of portable terminals.

【Disclosure】

【Technical Problem】

[20]

Since the voltage induced in the secondary coil of the wireless charger is determined by Faraday's law and Lenz's law, in order to obtain a high voltage signal, the larger the amount of magnetic flux that interlinks with the secondary coil, the more advantageous it is. The amount of magnetic flux increases as the amount of soft magnetic material included in the secondary coil increases and the permeability of the material increases. In particular, since the wireless charging device essentially transmits power in a contactless manner, in order to focus a wireless electromagnetic wave generated from a primary coil of the transmitting apparatus to the secondary coil of the receiving apparatus, the magnetic field shielding sheet on which the secondary coil is mounted needs to be made of a magnetic material with high permeability.

[21]

The conventional magnetic field shielding sheet for the wireless charger is a thin film and does not provide a solution to the problem of heat generation due to shielding and to increase the wireless charging efficiency. Accordingly, in the case of the amorphous ribbon, the present inventor has completed the present invention by recognizing that the inductance (permeability) is less reduced even when the ribbon becomes flake, and a quality factor Q of the secondary coil increases as the magnetoresistance is significantly reduced.

[22]

Therefore, the present invention has been proposed to solve the problems of the prior art, and an object of the present invention provides a magnetic field shielding sheet

for a wireless charger with excellent power transmission efficiency by significantly reducing a loss due to an eddy current by flake treatment of amorphous ribbon to increase a quality factor Q of a secondary coil while blocking an effect of a magnetic field on a main body and a battery of a portable terminal or the like, a method for manufacturing the same, and a receiving apparatus for a wireless charger using the sheet.
[23]

Another object of the present invention provides a magnetic field shielding sheet for a wireless charger capable of preventing moisture penetration by filling a gap between fine strands of amorphous ribbon with an adhesive by flake-treating the amorphous ribbon and then performing compression bonding lamination treatment on the amorphous ribbon, and reducing an eddy current and preventing shielding performance from deteriorating by enclosing all sides of the fine strands with the adhesive (dielectric) to isolate the fine strands from each other, and a method for manufacturing the same.
[24]

Another object of the present invention provides a magnetic field shielding sheet for a wireless charger with high power transmission efficiency even with a small number of nanocrystal grain ribbons by setting a shape of a shielding sheet to a shape similar to a secondary coil of a receiving apparatus for a wireless charger, and a receiving apparatus for a wireless charger using the same.
[25]

Another object of the present invention provides a magnetic field shielding sheet for a wireless charger with high productivity and low manufacturing cost while maintaining an original thickness of a sheet by sequentially performing flake and lamination treatment in a roll-to-roll method to mold the sheet, and a method for manufacturing the same.

【Technical Solution】
[26]

To achieve the above object, a magnetic field shielding sheet for a wireless charger includes: at least one single-layer thin magnetic sheet made of an amorphous ribbon separated into multiple fine strands; a protective film adhered onto one side of the thin magnetic sheet via a first adhesive layer; and a double-sided tape adhered onto the other side of the thin magnetic sheet via a second adhesive layer formed on one side of the double-sided tape, in which a gap among the multiple fine strands is filled with portions of the first adhesive layer and second adhesive layer such that the multiple fine strands are isolated from each other.
[27]

According to another aspect of the present invention, a method for manufacturing a magnetic field shielding sheet for a wireless charger includes: forming a laminated sheet by adhering a protective film and a double-sided tape having a release film on an exposed surface onto both sides of a thin magnetic sheet formed of at least one layer of amorphous ribbon; dividing the thin magnetic sheet into multiple fine strands by flake treatment of the laminated sheet; and laminating the flake-treated laminated sheet to planarize and slim the laminated sheet and filling the protective film and portions of the first and second adhesive layers provided on the double-sided tape in a gap between the multiple fine strands to isolate the multiple fine strands from each other.
[28]

According to still another aspect of the present invention, a receiving apparatus for a wireless charger that charges a secondary battery in an electromagnetic induction method from a transmitting apparatus of the wireless charger includes: a secondary coil that receives a radio high-frequency signal transmitted by an electromagnetic induction method from the transmitting apparatus; and a magnetic field shielding sheet that is disposed between the secondary coil and the secondary battery, and shields a magnetic field generated by the radio high-frequency signal and at the same time induces the

secondary coil to absorb the radio high-frequency signal required to perform the wireless charging function, in which the magnetic field shielding sheet includes: at least one single-layer thin magnetic sheet formed of an amorphous ribbon separated into multiple fine strands; a protective film adhered onto one side of the thin magnetic sheet via a first adhesive layer; and a double-sided tape adhered onto the other side of the thin magnetic sheet via a second adhesive layer formed on one side of the double-sided tape, and a gap among the multiple fine strands is filled with portions of the first adhesive layer and second adhesive layer such that the multiple fine strands are isolated from each other.

【Advantageous Effects】

[29]

As described above, according to the present invention, it is possible to make power transmission efficiency excellent by significantly reducing a loss due to an eddy current by flake treatment of amorphous ribbon to increase a quality factor Q of a secondary coil while blocking an effect of a magnetic field on a main body and a battery of a portable terminal or the like.

[30]

In addition, according to the present invention, it is possible to prevent moisture penetration by filling a gap between fine strands of amorphous ribbon with an adhesive by flake-treating the amorphous ribbon and then performing compression bonding lamination treatment on the amorphous ribbon and reduce an eddy current and prevent shielding performance from deteriorating by enclosing all surfaces of the fine strands with the adhesive (dielectric) to isolate the fine strands from each other. As a result, it is possible to prevent changes in appearance and deterioration in characteristics due to oxidation of an amorphous ribbon due to moisture penetration by enclosing all sides of the fine strand with adhesive (dielectric).

[31]

In addition, according to the present invention, it is possible to reduce a thickness of a sheet to 0.3 mm or less while exhibiting high power transmission efficiency or equivalent power transmission efficiency even with a small number of nanocrystal grain ribbons by setting a shape of a shielding sheet to a shape similar to that of a receiver coil.

[32]

In addition, according to the present invention, it is possible to increase productivity and save manufacturing cost while maintaining an original thickness of a sheet by sequentially performing flake and lamination treatment in a roll-to-roll method to mold the sheet.

【BRIEF DESCRIPTION OF THE DRAWINGS】

[33]

FIG. 1 is an exploded perspective view illustrating a magnetic field shielding sheet for a wireless charger according to the present invention.

[34]

FIG. 2 is a cross-sectional view illustrating an example of using a single sheet of nanocrystal grain ribbon sheet according to a first embodiment.

[35]

FIG. 3 is a cross-sectional view illustrating an example of using six nanocrystal grain ribbon sheet according to a second embodiment.

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