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Electronic device housing with protrusions and electronic device including the same

Abstract

According to certain embodiments, an electronic device housing comprises: a substrate including: a front surface comprising a plurality of front surface protrusions and a plurality of taper protrusions protruding from the plurality of front surface protrusions and a rear surface comprising a plurality of rear surface protrusions; and wherein two protrusions selected from the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions are different from each remaining ones of the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions; a deposition layer formed on the front surface of the substrate; and a transparent coating layer formed on the rear surface of the substrate.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation of International Application No. PCT/KR2022/007925 designating the United States, filed on Jun. 3, 2022, in the Korean Intellectual Property Receiving Office and claiming priority to Korean Patent Application No. 10-2021-0102091, filed on Aug. 3, 2021, in the Korean Intellectual Property Office, the disclosures of which are incorporated by reference herein in their entireties.

BACKGROUND

1. Field

(1) The disclosure relates to an electronic device housing with protrusions, and an electronic device including the same.

2. Description of Related Art

(2) An electronic device can be a device that performs a specific function according to a loaded program, such as a home appliance, an electronic note, a portable multimedia player, a mobile communication terminal, a tablet personal computer (PC), a video/audio device, a desktop/laptop computer, a vehicle navigation system, and the like. For example, such electronic devices may output stored information as sound or images. Along with an increase in the integration level of electronic devices and the increasing popularity of ultra-high-speed, large-capacity wireless communication, various functions have recently been loaded in a single electronic device, such as a mobile communication terminal. For example, an entertainment function such as gaming, a multimedia function such as music/video play, a communication and security function for mobile banking, a scheduling function, and an electronic wallet function, as well as a communication function, have been integrated into a single electronic device.

(3) An electronic device can include a housing formed of various materials. The housing of the electronic device may protect internal components of the electronic device from an external impact. In addition, the housing may be manufactured to be easily carried by a user. Additionally, the housing can be made to be aesthetically pleasing to the user. The housing may need to have a high strength and hardness to protect multiple internal components and modules of the electronic device, and may have excellent gloss for a quality of an exterior of the electronic device.

(4) An exterior surface of the housing (or a case) may also have be visually pleasing to differentiate from other electronic devices.

(5) If a film (e.g., a deco film) is added to the surface of the housing, it is important to be attached evenly to a corner or a curved surface in which several faces meet to avoid folding or wrinkling.

SUMMARY

(6) According to certain embodiments, an electronic device housing comprises: a substrate

including: a front surface comprising a plurality of front surface protrusions and a plurality of taper protrusions protruding from the plurality of front surface protrusions and a rear surface comprising a plurality of rear surface protrusions; and wherein two protrusions selected from the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions are different from each remaining ones of the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions; a deposition layer formed on the front surface of the substrate; and a transparent coating layer formed on the rear surface of the substrate. According to certain embodiments, an electronic device housing comprises: a substrate including: a front surface comprising a plurality of front surface protrusions; and a rear surface comprising a plurality of rear surface protrusions and a plurality of taper protrusions protruding from the plurality of rear surface protrusions; and wherein two protrusions selected from the plurality of front surface protrusions, rear surface protrusions, and taper protrusions are different from each remaining one of the plurality of front surface protrusions, plurality of rear surface protrusions, and plurality of taper protrusions; and a deposition layer formed on the front surface of the substrate; and a transparent coating layer formed on the rear surface of the substrate. According to certain embodiments, an electronic device enclosed by an electronic device housing, wherein the electronic device housing comprises: a substrate including: a front surface comprising a plurality of front surface protrusions and a plurality of taper protrusions protruding from the plurality of front surface protrusions, and a rear surface comprising a plurality of rear surface protrusions; and wherein two protrusions selected from the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions are different from remaining ones of the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions; a deposition layer formed on the front surface of the substrate; and a transparent coating layer formed on the rear surface of the substrate.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

- (1) The above and other aspects, features, and advantages of certain embodiments of the present disclosure will be more apparent from the following detailed description, taken in conjunction with the accompanying drawings, in which:
- (2) FIG. 1 is a perspective view of a front surface of a mobile electronic device according to an example embodiment;
- (3) FIG. 2 is a perspective view of a rear surface of the electronic device of FIG. 1;
- (4) FIG. 3 is an exploded perspective view of the electronic device of FIG. 1;
- (5) FIG. 4 is a cross-sectional view of an electronic device housing according to certain embodiments;
- (6) FIG. 5 is a cross-sectional view of a substrate of an electronic device housing according to certain embodiments;
- (7) FIG. 6 is a cross-sectional view of a substrate of an electronic device housing according to certain embodiments;
- (8) FIG. 7 is a cross-sectional view of a substrate of an electronic device housing according to certain embodiments;
- (9) FIG. 8 is a cross-sectional view of a substrate of an electronic device housing according to certain embodiments;
- (10) FIG. 9 is a cross-sectional view of a substrate of an electronic device housing according to certain embodiments;
- (11) FIG. 10 is a cross-sectional view of an electronic device housing according to certain

embodiments;

(12) FIGS. **11A** through **11C** illustrate actual images of an electronic device to which an electronic device housing is applied, according to certain embodiments;

(13) FIG. **12** is a flowchart illustrating a method of manufacturing an electronic device housing according to certain embodiments;

(14) FIG. **13** is a perspective view of a mold for manufacturing an electronic device housing according to certain embodiments; and

(15) FIGS. **14A** through **14D** illustrate images obtained by capturing a surface of a mold according to certain embodiments.

DETAILED DESCRIPTION

(16) Hereinafter, example embodiments will be described in detail with reference to the accompanying drawings. When describing the example embodiments with reference to the accompanying drawings, like reference numerals refer to like elements and a repeated description related thereto will be omitted.

(17) Certain embodiments provide an electronic device housing that may realize a visual surface texture without a limitation of a surface shape, and an electronic device including the same.

(18) Certain embodiments provide an electronic device housing on which a surface pattern having a sense of perspective is formed, and an electronic device including the same.

(19) An electronic device housing according to certain embodiments may include a front surface including a plurality of protrusions, and a rear surface including a plurality of protrusions. The plurality of protrusions may be different from each other in at least one of a width, a depth, and a pitch.

(20) An electronic device according to certain embodiments may be enclosed by an electronic device housing, and the electronic device housing may include a plurality of protrusions formed on a surface of the electronic device housing.

(21) A method of manufacturing an electronic device housing according to certain embodiments may include preparing a mold including a plurality of intaglio patterns, injection molding a housing using the mold, forming a transparent coating layer on one surface of the housing, and forming at least one of a deposition layer, a paint layer, and a shielding layer on an opposite surface of the housing.

(22) FIGS. **1** and **2** describe a housing of an electronic device **100**. The housing **110** of the electronic device **100** may protect internal components of the electronic device **100** from an external impact. In addition, the housing **110** may be manufactured to be easily carried by a user. Additionally, the housing **110** can be made to be aesthetically pleasing to the user. The housing **110** may need to have a high strength and hardness to protect multiple internal components and modules of the electronic device **100**, and may have excellent gloss for a quality of an exterior of the electronic device.

(23) An exterior surface **110A**, **110B** of the housing (or a case) may have be visually pleasing to differentiate from other electronic devices.

(24) Housing

(25) FIG. **1** is a perspective view of a front surface of a mobile electronic device according to an example embodiment.

(26) FIG. **2** is a perspective view of a rear surface of the electronic device of FIG. **1**.

(27) Referring to FIGS. **1** and **2**, an electronic device **100** according to an embodiment may include a housing **110** including a first surface (or a front surface) **110A**, a second surface (or a rear surface) **110B**, and a side surface **110C** surrounding a space between the first surface **110A** and the second surface **110B**. In an example embodiment (not shown), the housing may also refer to a structure which forms a portion of the first surface **110A**, the second surface **110B**, and the side surface **110C** of FIG. **1**. According to an example embodiment, the first surface **110A** may be formed by a front plate **102** (e.g., a glass plate or a polymer plate including various coating layers)

of which at least a portion is substantially transparent. The second surface **110B** may be formed of a rear plate **111** that is substantially opaque. For example, the rear plate **111** may be formed of coated or colored glass, ceramic, polymer, metal materials (e.g. Aluminum, stainless steel (SS), or magnesium) or a combination of at least two of the above materials. The side surface **110C** may be coupled to the front plate **102** and the rear plate **111** and may be formed by a side bezel structure (or a “side member”) **118** including a metal and/or a polymer. In an example embodiment, the rear plate **111** and the side bezel structure **118** may be integrally formed and may include the same material (e.g., a metal material such as aluminum).

(28) In the illustrated example embodiment, the front plate **102** may include two first areas **110D** that are curved and extended seamlessly from the first surface **110A** toward the rear plate **111** at both ends of a long edge of the front plate **102**. In the illustrated example embodiment (see FIG. 2), the rear plate **111** may include two second areas **110E** that are curved and extended seamlessly from the second surface **110B** toward the front plate **102** at both ends of a long edge thereof. In some example embodiments, the front plate **102** (or the rear plate **111**) may include only one of the first areas **110D** (or the second areas **110E**). In an example embodiment, some of the first areas **110D** or the second area **110E** may not be included. In the above example embodiments, in a side view of the electronic device **100**, the side bezel structure **118** may have a first thickness (or width) at a side in which the first areas **110D** or the second areas **110E** are not included, and may have a second thickness less than the first thickness at a side in which the first areas **110D** or the second areas **110E** are included.

(29) According to an example embodiment, the electronic device **100** may include at least one of a display **101**, audio modules **103**, **107**, and **114**, sensor modules **104**, **116**, and **119**, camera modules **105**, **112**, and **113**, key input devices **117**, a light-emitting element **106**, and connector holes **108** and **109**. In some example embodiments, the electronic device **100** may not include at least one (e.g., the key input devices **117** or the light-emitting element **106**) of the components, or may additionally include other components.

(30) The display **101** may be exposed through, for example, some portions of the front plate **102**. In some example embodiments, at least a portion of the display **101** may be exposed through the first surface **110A** and the front plate **102** constructing the first areas **110D** of the side surface **110C**. In some example embodiments, an edge of the display **101** may be formed to be substantially the same as the shape of the periphery of the front plate **102** adjacent thereto. In another example embodiment (not shown), in order to enlarge the exposed area of the display **101**, a distance between the edge of the display **101** and the periphery of the first plate **102** may be substantially the same.

(31) In an example embodiment (not shown), a recess or an opening may be formed in a portion of a screen display area of the display **101**, and at least one of the audio module **114**, the sensor module **104**, and the camera module **105**, and the light-emitting element **106** that are aligned with the recess or the opening may be included. In an example embodiment (not shown), a rear surface of the screen display area of the display **101** may include at least one of the audio module **114**, the sensor module **104**, the camera module **105**, the sensor module **116** (e.g., a fingerprint sensor), and the light-emitting element **106**. In an example embodiment (not shown), the display **101** may be coupled to or disposed adjacent to a touch sensing circuit, a pressure sensor for measuring an intensity (pressure) of a touch, and/or a digitizer for detecting a magnetic-type stylus pen. In some example embodiments, at least a portion of the sensor modules **104** and **119**, and/or at least a portion of the key input device **117** may be disposed in the first areas **110D** and/or the second areas **110E**.

(32) The audio modules **103**, **107**, and **114** may include a microphone hole (e.g., the audio module **103**) and speaker holes (e.g., the audio modules **107** and **114**). A microphone for acquiring an external sound may be disposed in the microphone hole (e.g., the audio module **103**). In some example embodiments, a plurality of microphones may be disposed to detect a direction of a sound.

The speaker holes (e.g., the audio modules **107** and **114**) may include an external speaker hole (e.g., the audio module **107**), and a receiver hole (e.g., the audio module **114**) for a call. In some example embodiments, the speaker holes (e.g., the audio modules **107** and **114**) and the microphone hole (e.g., the audio module **103**) may be implemented as a single hole, or a speaker (e.g., a piezo speaker) may be included without the speaker holes (e.g., the audio modules **107** and **114**).

(33) The sensor modules **104**, **116**, and **119** may generate an electrical signal or a data value corresponding to an internal operating state of the electronic device **100** or an external environmental state. The sensor modules **104**, **116**, and **119** may include, for example, a first sensor module **104** (e.g., a proximity sensor) and/or a second sensor module (not shown) (e.g., a fingerprint sensor) disposed on the first surface **110A** of the housing **110**, and/or a third sensor module **119** (e.g., a heart rate monitoring (HRM) sensor) and/or a fourth sensor module **116** (e.g., a fingerprint sensor) disposed on the second surface **110B** of the housing **110**. The fingerprint sensor may be disposed on both the first surface **110A** (e.g., the display **101**) and the second surface **110B** of the housing **110**. The electronic device **100** may further include at least one of sensor modules (not shown), for example, a gesture sensor, a gyro sensor, an atmospheric pressure sensor, a magnetic sensor, an acceleration sensor, a grip sensor, a color sensor, an infrared (IR) sensor, a biometric sensor, a temperature sensor, a humidity sensor, and an illuminance sensor **104**.

(34) The camera modules **105**, **112**, and **113** may include a first camera device **105** disposed on the first surface **110A** of the electronic device **100**, a second camera device **112** disposed on the second surface **110B**, and/or a flash **113**. The camera modules **105** and **112** may each include one or more lenses, an image sensor, and/or an image signal processor. The flash **113** may include, for example, a light-emitting diode (LED) or a xenon lamp. In some example embodiments, two or more lenses (e.g., IR camera, wide-angle, and telephoto lenses) and image sensors may be disposed on one surface of the electronic device **100**.

(35) The key input device **117** may be disposed on the side surface **110C** of the housing **110**. In an example embodiment, the electronic device **100** may not include some or all of the above-described key input devices **117**. The key input device **117** that is not included may be implemented in another form such as a soft key on the display **101**. In some example embodiments, the key input device **117** may include the sensor module **116** disposed on the second surface **110B** of the housing **110**.

(36) The light-emitting element **106** may be disposed on, for example, the first surface **110A** of the housing **110**. The light-emitting element **106** may provide, for example, state information of the electronic device **100** in a form of light. In an example embodiment, the light-emitting element **106** may provide, for example, a light source that is linked to an operation of the camera module **105**. The light-emitting element **106** may include, for example, an LED, an IR LED, and a xenon lamp.

(37) The connector holes **108** and **109** may include a first connector hole **108** for accommodating a connector (e.g., a universal serial bus (USB) connector) for transmitting and receiving power and/or data to and from an external electronic device, and/or a second connector hole **109** (e.g., an earphone jack) for accommodating a connector for transmitting and receiving an audio signal to and from an external electronic device.

(38) FIG. **3** is an exploded perspective view of the electronic device of FIG. **1**. Referring to FIG. **3**, an electronic device **300** may include a side bezel structure **310**, a first support member **311** (e.g., a bracket), a front plate **320**, a display **330**, a printed circuit board (PCB) **340**, a battery **350**, a second support member **360** (e.g., a rear case), an antenna **370**, and a rear plate **380**. In some example embodiments, the electronic device **300** may not include at least one (e.g., the first support member **311** or the second support member **360**) of the components, or may additionally include other components. At least one of the components of the electronic device **300** may be the same as or similar to at least one of the components of the electronic device **100** of FIG. **1** or **2**, and a repeated description thereof will be omitted hereinafter.

(39) The first support member **311** may be disposed inside the electronic device **300** and connected

to the side bezel structure **310**, or may be formed integrally with the side bezel structure **310**. The first support member **311** may be formed of, for example, a metal material and/or anon-metal material (e.g., polymer). The display **330** may be connected to one surface of the first support member **311**, and the PCB **340** may be connected to another surface of the first support member **311**. A processor, a memory, and/or an interface may be mounted on the PCB **340**. The processor may include, for example, one or more of a central processing unit, an application processor, a graphics processing unit, an image signal processor, a sensor hub processor, and a communication processor.

(40) The memory may include, for example, a volatile memory or a non-volatile memory.

(41) The interface may include, for example, a high-definition multimedia interface (HDMI), a USB interface, a secure digital (SD) card interface, or an audio interface. For example, the interface may electrically or physically connect the electronic device **300** to an external electronic device, and may include a USB connector, an SD card/multimedia card (MMC) connector, or an audio connector.

(42) The battery **350**, which is a device for supplying power to at least one component of the electronic device **300**, may include, for example, a primary cell that is not rechargeable, a secondary cell that is rechargeable, or a fuel cell. For example, at least a portion of the battery **350** may be disposed on substantially the same plane as the PCB **340**. The battery **350** may be disposed integrally inside the electronic device **300**, or disposed detachably from the electronic device **300**.

(43) The antenna **370** may be disposed between the rear plate **380** and the battery **350**. The antenna **370** may include, for example, a near field communication (NFC) antenna, a wireless charging antenna, and/or a magnetic secure transmission (MST) antenna. The antenna **370** may perform short-range communication with an external device, or may wirelessly transmit and receive power required for charging to and from the external device. In an example embodiment, an antenna structure may be formed by a portion of the side bezel structure **310** and/or the first support member **311** or a combination thereof.

(44) A film (e.g., a deco film) may be added to the surface of the housing to improve aesthetic appearance. However, it is important that the film be attached evenly to a corner or a curved surface in which several faces meet to avoid folding or wrinkling.

(45) FIG. 4 is a cross-sectional view of an electronic device housing according to certain embodiments.

(46) An electronic device housing **400** may have a rear plate (e.g., the rear plate **111** of FIG. 1, and the rear plate **380** of FIG. 3). When one surface of the electronic device housing **400** is referred to as a front surface, a surface opposite to the one surface may be referred to as a rear surface.

(47) The terms “front surface” and “rear surface” of the electronic device housing **400** may be used to indicate one surface and the opposite surface of the electronic device housing **400**, not a surface facing a predetermined direction of the electronic device housing **400**.

(48) The electronic device housing **400** may include a substrate **410**, a deposition layer **440** formed on a front surface **420** of the substrate **410**, and a transparent coating layer **450** formed on a rear surface **430** of the substrate **410**. The front surface **420** of the substrate **410** may include a plurality of front surface protrusions **421** and a plurality of taper protrusions **422** protruding from the front protrusions **421**, and the rear surface **430** may include a plurality of rear surface protrusions **431**. According to certain embodiments, the deposition layer **440** may be formed to cover a substantially flat area (that is an area in which a protrusion is not formed), the front surface protrusions **421** and the taper protrusions **422** of the front surface **420**. The transparent coating layer **450** may be formed to cover a substantially flat area (that is an area in which a protrusion is not formed) and the rear surface protrusions **431** of the rear surface **430**.

(49) A protrusion may be formed to protrude outwardly from an electronic device housing to have a convex shape, and may function as a convex lens by refracting light passing through the electronic device housing.

(50) The transparent coating layer **450** may be formed to protect the electronic device housing **400** and the substrate **410**, and may prevent the electronic device housing **400** from being corroding, contaminated, scratched, and/or worn away due to an external environment. According to certain embodiments, the transparent coating layer **450** may be a path through which light enters and exits from the electronic device housing **400**. According to certain embodiments, a print layer **460** may be further formed between the transparent coating layer **450** and the rear surface **430**. The print layer **460** may be formed to partially or completely cover the rear surface **430**, and may be partially formed along the rear surface **430** based on a pattern, and/or a design the electronic device housing **400** intends to represent.

(51) The deposition layer **440** may be formed on the front surface **420** of the substrate **410**. According to certain embodiments, at least one of a paint layer **470** and a shielding layer **480** may be further formed on the deposition layer **440**. In FIG. 4, the deposition layer **440** may be formed on the front surface **420** of the substrate **410**, and the paint layer **470** and the shielding layer **480** may be sequentially formed on the deposition layer **440**. According to certain embodiments, the deposition layer **440** may be formed to cover the substantially flat area, the front surface protrusions **421** and the taper protrusions **422** of the front surface **420**. According to certain embodiments, either the paint layer **470** or the shielding layer **480** may be formed on the deposition layer **440**, or both the paint layer **470** and the shielding layer **480** may be formed. The paint layer **470** and the shielding layer **480** may be formed in any order.

(52) The deposition layer **440** formed on the front surface **420** of the substrate **410** of the electronic device housing **400** may include a metal component, for example, various metal materials, such as indium, titanium oxide, aluminum oxide, or silicon oxide, and may provide a sense of beauty by increasing a surface reflectance of the electronic device housing **400**. According to certain embodiments, the paint layer **470** may be formed on the deposition layer **440**. The paint layer **470**, which is an opaque thin film layer, may provide a color or tint to the electronic device housing **400**, and may allow a color of the deposition layer **440** to be tinted. The shielding layer **480** may be formed on the deposition layer **440** or the paint layer **470**. The shielding layer **480** may perform a shielding function so that an inside of an electronic device (e.g., the electronic device **100** of FIG. 1, and the electronic device **300** of FIG. 3) is not visible. The shielding layer **480** may include various materials for shielding electromagnetic waves (e.g., electromagnetic interference (EMI) shielding).

(53) At least one of the front surface protrusions **421**, the taper protrusions **422**, and the rear surface protrusions **431** may have a shape of at least one of a hemisphere, a hexahedron, a cylinder, and a triangular pyramid. A cross section of at least one of the front surface protrusions **421**, the taper protrusions **422**, and the rear surface protrusions **431** may have a shape of at least one of a circle, a triangle, a quadrangle, a pentagon, and a hexagon. The shape of at least one of the front surface protrusions **421**, the taper protrusions **422**, and the rear surface protrusions **431**, or the shape of the cross section thereof may be determined based on a shape of a mold for manufacturing the electronic device housing **400**, and may also be determined based on an intaglio pattern engraved in the mold by an engraving process.

(54) At least one of the taper protrusions **422** may be formed from a central portion of the front surface protrusions **421**. A central axis of at least one of the front surface protrusions **421** may be identical to or coincide with a central axis of at least one of the taper protrusions **422**. At least one of the taper protrusions **422** may be formed to include a central axis of at least one of the front surface protrusions **421**. At least one of the taper protrusions **422** may be formed to include a central axis of at least one of the front surface protrusions **421**. At least one of the taper protrusions **422** may be formed to protrude further than the front surface protrusions **421**. A central axis of at least one of fourth protrusions (e.g., fourth protrusions **932** of FIG. 9) that will be described below, may be identical to or coincide with a central axis of at least one of the rear surface protrusions **431**, similarly to the front surface protrusions **421** and the taper protrusions **422**.

(55) A front surface protrusion **421** may have a width of 0.01 mm to 1 mm. A width of a taper protrusion **422** may be less than the width of the front surface protrusion **421**. A rear surface protrusion **431** may have a width of 0.01 mm to 1 mm. The width of the rear surface protrusion **431** may be greater than the width of the front surface protrusion **421**.

(56) A depth of a front surface protrusion **421** and a depth of a taper protrusion **422** may be different from each other. The depth of the taper protrusion **422** may be greater than the depth of the front surface protrusion **421**, and a difference between the depth of the front surface protrusion **421** and the depth of the taper protrusion **422** may be less than or equal to 10 μm . According to certain embodiments, the difference between the depth of the front surface protrusion **421** and the depth of the taper protrusion **422** may desirably be less than or equal to 8 μm .

(57) The depth of the front surface protrusion **421** may range from 5 μm to 15 μm , and the depth of the taper protrusion **422** may range from 20 μm to 30 μm . The depth of the taper protrusion **422** may be greater than the depth of the front surface protrusion **421**, and an image may be viewed in a magnified state due to interference and refraction of light passing through the front surface protrusion **421** and the taper protrusion **422**. A rear surface protrusion **431** may have a depth of 5 μm to 15 μm .

(58) According to certain embodiments, a ratio between a depth of a first protrusion **421** and a depth of a second protrusion **422** may range from 1:1.5 to 1:4. According to certain embodiments, the depth of the second protrusion **422** may be greater than the depth of the first protrusion **421**, and an image may be viewed in a magnified state due to interference and refraction of light passing through the first protrusion **421** and the second protrusion **422**. According to certain embodiments, a ratio between a depth of a third protrusion **431** and a depth of a fourth protrusion (e.g., a fourth protrusion **932** of FIG. 9) that will be described below may range from 1:1.5 to 1:4, similarly to the first protrusion **421** and the second protrusion **422**.

(59) According to certain embodiments, a pitch of a first protrusion **421** may be an integer multiple of a pitch of a second protrusion **422**. According to certain embodiments, the pitch of the taper protrusions **422** may be an integer multiple of the pitch of the front surface protrusions **421**. According to certain embodiments, each protrusion may be formed so that a central axis of at least one of the front surface protrusions **421** may coincide with a central axis of at least one of the taper protrusions **422**. Since pitches of the front surface protrusions **421** and pitches of the taper protrusions **422** have an integer multiple relationship with each other, all the front surface protrusions **421** may be formed to overlap the taper protrusions **422**, or all the taper protrusions **422** may be formed to overlap the front surface protrusions **421**.

(60) The electronic device housing **400** may have a transmittance of 50% or greater and a haze value of 30% or less. If the transmittance of the electronic device housing **400** increases and if the haze value decreases, an amount of light passing through the electronic device housing **400** may increase, which may facilitate realizing a visual surface texture by spectroscopy.

(61) The substrate **410** of the electronic device housing **400** may be formed of a polymer, for example, a styrene-acrylonitrile (SAN), polymethyl methacrylate (PMMA), polycarbonate (PC), acrylonitrile butadiene styrene (ABS), polybutylene terephthalate (PBT), polyethylene terephthalate (PET), or polyoxymethylene (POM). The electronic device housing **400** may be transparent or substantially transparent, and may include a translucent material, and light may pass through the transparent coating layer **450** of the electronic device housing **400**.

(62) Due to interference and refraction of light passing through and/or reflected by the electronic device housing **400**, an image may be viewed in a magnified state through the electronic device housing **400**. In particular, a pattern shape with a sense of perspective by overlapping of the front surface protrusions **421**, the taper protrusions **422**, and/or the rear surface protrusions **431** may be exhibited. The electronic device housing **400** may perform a function of a convex lens due to overlapping of the rear surface protrusions **431**.

(63) The substrate **410** of the electronic device housing **400** may be formed by injection, and the

substrate **410** may include at least one polymer among styrene-acrylonitrile (SAN), polymethyl methacrylate (PMMA), polycarbonate (PC), acrylonitrile butadiene styrene (ABS), polybutylene terephthalate (PBT), polyethylene terephthalate (PET), and polyoxymethylene (POM). The electronic device housing **400** may be formed through ultraviolet (UV) molding. For example, a substrate including the front surface protrusions **421**, the taper protrusions **422** and the rear surface protrusions **431**, and an electronic device housing may be manufactured by a scheme of injecting a UV curable resin into a mold with a pattern, placing a polymer resin on the mold, pressing the polymer resin, irradiating UV rays, and performing UV-curing.

(64) The substrate **410** may have a curved surface and may be injection molded through a mold. For example, a substrate injection molded through a mold with a curved surface may include a curved surface. It shall be understood that objects formed by injection molding have structure that is the inverse of the mold to a higher degree than objects that are formed by adding parts. A plurality of protrusions may also be formed on the curved surface of the substrate **410** of the electronic device housing **400**.

(65) Hereinafter, a structure of a substrate according to certain embodiments will be described in more detail.

(66) FIG. 5 is a cross-sectional view of a substrate of an electronic device housing according to certain embodiments.

(67) According to certain embodiments, a front surface **520** (e.g., the front surface **420** of FIG. 4) of a substrate **510** (e.g., the substrate **410** of FIG. 4) may include a front surface protrusion **521** (e.g., the front surface protrusion **421** of FIG. 4), and a taper protrusion **522** (e.g., the taper protrusion **422** of FIG. 4). A plurality of front surface protrusions **521** and/or a plurality of taper protrusions **522** may be formed.

(68) According to certain embodiments, the plurality of front surface protrusions **521** front surface protrusions **521** and the plurality of taper protrusions **522** may each have a width, a depth, and a pitch. A depth of each of the front surface protrusion **521** and the taper protrusion **522** may be measured based on an imaginary area or surface extending from an area of the front surface **520** that is flat or in which the front surface protrusion **521** and/or the taper protrusion **522** are not formed. A width of each of the front surface protrusion **521** and the taper protrusion **522** may be measured based on an imaginary line or surface extending from the area of the front surface **520** in which the front surface protrusion **521** and/or the taper protrusion **522** are not formed. A pitch of each of the front surface protrusion **521** and the taper protrusion **522** may refer to a minimum distance between protrusions. Here, a width, a depth, and a pitch of protrusions may refer to an average width, an average depth, and an average pitch, respectively.

(69) The front surface protrusion **521** and the taper protrusion **522** may overlap each other. The front surface protrusion and the taper protrusion may partially overlap, or may not overlap at all. In FIG. 5, the front surface protrusion **521** and the taper protrusion **522** may be formed to fully overlap each other.

(70) According to certain embodiments, one of the front surface protrusions **521** may be different from the other front surface protrusions **521**, or one of taper protrusions **522** may be different from the other taper protrusions **522** in at least one of a width, a depth, and a pitch. In FIG. 5, the front surface protrusion **521** and the taper protrusion **522** may have the same pitch and different widths and depths.

(71) A rear surface **530** of the substrate **510** may include a rear surface protrusion **531**. According to certain embodiments, a plurality of rear surface protrusions **531** may be formed. The front surface protrusion **521**, the taper protrusion **522**, and the rear surface protrusion **531** may be formed to protrude from the substrate **510** and may have different shapes. According to certain embodiments, two protrusions among the front surface protrusions **521**, the taper protrusions **522**, and the rear surface protrusions **531** may be different from each of the remaining ones of the front surface protrusions **521**, taper protrusions **522**, and rear surface protrusions **531** in at least one of a width, a

depth, and a pitch.

(72) That is, if one of the two protrusions is a front surface protrusion **521**, the front surface protrusion is different in at least one of a width, a depth, and a pitch from each one of the remaining front surface protrusions **521**. If one of the two protrusions is a taper protrusion **522**, the taper protrusion **522** is different in at least one of a width, a depth, and a pitch from each one of the remaining taper protrusions **522**. If one of the two protrusions is a rear surface protrusion **531**, the rear surface protrusion **531** is different in at least one of a width, a depth, and a pitch from each one of the remaining rear surface protrusions **531**. In In this context, it shall be understood that different shall be understood to mean any one of substantially different, a deviation that is in excess of manufacturing deviations that are commonly encountered when equal is intended, or a difference may be in excess of 3%.

(73) A depth of the rear surface protrusion **531** may be measured based on an area of the rear surface **530** in which the rear surface protrusion **531** is not formed. A width of the third protrusion **531** may be measured based on an imaginary line or surface extending from the area of the rear surface **530** in which the third protrusion **531** is not formed. A pitch of the third protrusions **531** may refer to a minimum distance between protrusions.

(74) FIG. **6** is a cross-sectional view of a substrate of an electronic device housing according to certain embodiments.

(75) A front surface **620** of a substrate **610** (e.g., the substrate **410** of FIG. **4**) of an electronic device housing **600** (e.g., the electronic device housing **400** of FIG. **4**) may include a plurality of front surface protrusions **621** (e.g., the front surface protrusions **421** of FIG. **4**) a plurality of taper protrusion **622** (e.g., the taper protrusions **422** of FIG. **4**) and a plurality of second front surface protrusions **623**, and a rear surface **630** of the substrate **610** may include a plurality of rear surface protrusions **631** (e.g., the rear surface protrusions **431** of FIG. **4**). Two protrusions selected from the front surface protrusions **621**, the taper protrusion **622**, and the rear surface protrusions **631** may be different from each of the remaining ones of the front surface protrusions **621**, taper protrusions **622**, and rear surface protrusions **631** in at least one of a width, a depth, and a pitch. A width, a depth, and a pitch of protrusions may be determined according to criteria, as described above. Here, the width, the depth, and the pitch of the protrusions may refer to an average width, an average depth, and an average pitch, respectively.

(76) Referring to FIG. **6**, the front surface protrusions **621**, the taper protrusion **622**, and the second front surface protrusions **623** included in the front surface **620** of the substrate **610** may be different in all a width, a depth, and a pitch. More specifically, a pitch of a taper protrusion **622** may be less than or equal to half of a pitch of a front surface protrusion **621**. According to certain embodiments, the pitch of the second front surface protrusions **623** may be less than the pitch of the first protrusion **621**, and the second front surface protrusions **623** may be formed so as not to overlap the first protrusion **621**.

(77) FIG. **7** is a cross-sectional view of a substrate of an electronic device housing according to certain embodiments.

(78) A front surface **720** (e.g., the front surface **420** of FIG. **4**) of a substrate **710** (e.g., the substrate **410** of FIG. **4**) of an electronic device housing **700** (e.g., the electronic device housing **400** of FIG. **4**) may include a plurality of front surface protrusions **721** (e.g., the front surface protrusions **421** of FIG. **4**) and a plurality of taper protrusions **722** (e.g., the taper protrusions **422** of FIG. **4**), and a rear surface **730** (e.g., the rear surface **430** of FIG. **4**) of the substrate **710** may include a plurality of rear surface protrusions **731** (e.g., the rear surface protrusions **431** of FIG. **4**). Two protrusions selected from the front surface protrusions **721**, the taper protrusions **722**, and the rear surface protrusions **731** may be different from each of the remaining front surface protrusions **721**, the taper protrusions **722**, and the rear surface protrusions **731** in at least one of a width, a depth, and a pitch. A width, a depth, and a pitch of protrusions may be determined according to criteria, as described above. Here, the width, the depth, and the pitch of the protrusions may refer to an

average width, an average depth, and an average pitch, respectively.

(79) Referring to FIG. 7, the front surface protrusions **721** and the taper protrusions **722** included in the front surface **720** of the substrate **710** may be different in all a width, a depth, and a pitch. More specifically, a pitch of a taper protrusion **722** may be greater than or equal to half of a pitch of a front surface protrusion **721**. The pitch of the taper protrusion **722** may be greater than the pitch of the front surface protrusion **721**, and the front surface protrusion **721** may be formed so as not to overlap the taper protrusion **722**.

(80) FIG. 8 is a cross-sectional view of a substrate of an electronic device housing according to certain embodiments.

(81) A front surface **820** (e.g., the front surface **420** of FIG. 4) of a substrate **810** (e.g., the substrate **410** of FIG. 4) of an electronic device housing **800** (e.g., the electronic device housing **400** of FIG. 4) may include a plurality of front surface protrusions **821** (e.g., the front surface protrusions **421** of FIG. 4) and a plurality of taper protrusions **822** (e.g., the taper protrusions **422** of FIG. 4), and a rear surface **830** (e.g., the rear surface **430** of FIG. 4) of the substrate **810** may include a plurality of rear surface protrusions **831** (e.g., the rear surface protrusions **431** of FIG. 4). According to certain embodiments, the plurality of taper protrusions **822** may be different from each other in a depth and/or width. Here, a width and a depth of protrusions may refer an average width and an average depth, respectively.

(82) FIG. 9 is a cross-sectional view of a substrate of an electronic device housing according to certain embodiments.

(83) According to certain embodiments, a rear surface **930** (e.g., the rear surface **430** of FIG. 4) of a substrate **910** (e.g., the substrate **410** of FIG. 4) of an electronic device housing **900** (e.g., the electronic device housing **400** of FIG. 4) may further include another plurality of taper protrusions **932** protruding from the rear surface protrusions **931**. The taper protrusions **932** protruding from the rear surface protrusions **931** may fully or partially overlap rear surface protrusions **931** (e.g., the rear surface protrusions **431** of FIG. 4), or may not completely overlap the third protrusions **931**. A rear surface protrusion **931** and a taper protrusion **932** may be different from each other in at least one of a width, a depth, and a pitch. According to certain embodiments, two protrusions selected from front surface protrusions **921** (e.g., the front surface protrusions **421** of FIG. 4), taper protrusions **922** protruding from the front surface protrusions **921** (e.g., the taper protrusions **422** of FIG. 4), the rear surface protrusions **931** and the taper protrusions **932** protruding from the rear surface protrusions **931** may be different from each other in at least one of a width, a depth, and a pitch. Here, a width, a depth, and a pitch of protrusions may refer to an average width, an average depth, and an average pitch, respectively.

(84) According to certain embodiments, a width of a taper protrusion **932** (e.g., a fourth protrusion **932** of FIG. 9) may be less than the width of the rear surface protrusion **931**, similarly to the front surface protrusion **921** and the taper protrusion **922**. A depth of a rear surface protrusion **931** and a depth of a taper protrusion **932** may be different from each other, and a difference between the depth of the rear surface protrusion **931** and the depth of the taper protrusion **932** may be less than or equal to 10 μm , similarly to the front surface protrusion **921** and the taper protrusion **922**. According to certain embodiments, a taper protrusion **932** may have a depth of 20 μm to 30 μm , similarly to the taper protrusion **922**. A pitch of a rear surface protrusion **931** may be an integer multiple of a pitch of a taper protrusion **932**, similarly to the front surface protrusion **921** and the taper protrusion **922**.

(85) A taper protrusion **932** may have a shape of at least one of a hemisphere, a hexahedron, a cylinder, and a triangular pyramid. According to certain embodiments, a cross section of the taper protrusions **932** may have a shape of at least one of a circle, a triangle, a quadrangle, a pentagon, and a hexagon. According to certain embodiments, the shape of the taper protrusion **932**, or the shape of the cross section thereof may be determined based on a shape of a mold for manufacturing the electronic device housing **900**, and may also be determined based on an intaglio pattern

engraved in the mold by an engraving process.

(86) At least one of the taper protrusions **932** may be formed from a central portion of the third protrusions **931**. According to certain embodiments, a central axis of at least one of the third protrusions **931** may be identical to or coincide with a central axis of at least one of the taper protrusions **932**. According to certain embodiments, at least one of the taper protrusions **932** may be formed to include a central axis of at least one of the third protrusions **931**. According to certain embodiments, at least one of the taper protrusions **932** may be formed to include a central axis of at least one of the third protrusions **931**. At least one of the taper protrusions **932** may be formed to protrude further than the third protrusions **931**.

(87) A rear surface protrusion **931** may have a width of 0.01 mm to 1 mm. According to certain embodiments, a width of a taper protrusion **932** may be less than the width of the rear surface protrusion **931**.

(88) A depth of a rear surface protrusion **931** and a depth of a taper protrusion **932** may be different from each other. According to certain embodiments, the depth of the taper protrusion **932** may be greater than the depth of the rear surface protrusion **931**, and a difference between the depth of the rear surface protrusion **931** and the depth of the taper protrusion **932** may be less than or equal to 10 μm . The difference between the depth of the taper protrusion **931** and the depth of the taper protrusion **932** may desirably be greater than 0 μm and less than or equal to 8 μm .

(89) A rear surface protrusion **931** may have a depth of 5 μm to 15 μm , and a taper protrusion **932** may have a depth of 20 μm to 30 μm . According to certain embodiments, the depth of the taper protrusion **932** may be greater than the depth of the rear surface protrusion **931**, and an image may be viewed in a magnified state due to interference and refraction of light passing through the rear surface protrusion **931** and the taper protrusion **932**.

(90) A ratio between a depth of a rear surface protrusion **931** and a depth of a taper protrusion **932** may range from 1:1.5 to 1:4. According to certain embodiments, the depth of the taper protrusion **932** may be greater than the depth of the rear surface protrusion **931**, and an image may be viewed in a magnified state due to interference and refraction of light passing through the third protrusion **931** and the taper protrusion **932**.

(91) A pitch of a rear surface protrusion **931** may be an integer multiple of a pitch of a taper protrusion **932**. The pitch of the taper protrusion **932** may be an integer multiple of the pitch of the rear surface protrusion **931**. Each protrusion may be formed so that a central axis of at least one of the rear surface protrusions **931** may coincide with a central axis of at least one of the taper protrusions **932**. Since pitches of the rear surface protrusions **931** and pitches of the taper protrusions **932** have an integer multiple relationship with each other, all the rear surface protrusions **931** may be formed to overlap the taper protrusions **932**, or all the taper protrusions **932** may be formed to overlap the rear surface protrusions **931**.

(92) According to certain embodiments, an electronic device housing (e.g., the electronic device housing **400** of FIG. 4) may include a substrate (e.g., the substrate **410** of FIG. 4) including a front surface (e.g., the front surface **420** of FIG. 4) comprising a plurality of front surface protrusions (e.g., the front surface protrusions **421** of FIG. 4) and a plurality of taper protrusions (e.g., the taper protrusions **422** of FIG. 4) protruding from the plurality of front surface protrusions, and a rear surface (e.g., the rear surface **430** of FIG. 4) comprising a plurality of rear surface protrusions (e.g., the rear surface protrusions **431** of FIG. 4), wherein two protrusions selected from the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions are different from each remaining ones of the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions. Two protrusions selected from the first protrusions, the second protrusions, and the third protrusions may be different from each other in at least one of a width, a depth, and a pitch, a deposition layer (e.g., the deposition layer **440** of FIG. 4) formed on a front surface (e.g., the front surface **420** of FIG. 4) of the substrate, and a transparent coating layer (e.g., the transparent coating layer **450** of FIG. 4) formed

on a rear surface (e.g., the rear surface **430** of FIG. **4**) of the substrate.

(93) According to certain embodiments, at least one of the plurality of front surface protrusions (e.g., the plurality of front surface protrusions **421** of FIG. **4**), plurality of taper protrusions (e.g., the plurality of taper protrusion **422** of FIG. **4**) protruding from the plurality of front surface protrusions, and the plurality of rear surface protrusion (e.g., the plurality of rear surface protrusions **431** of FIG. **4**) may have a shape of at least one of a hemisphere, a hexahedron, a cylinder, and a triangular pyramid.

(94) According to certain embodiments, a central axis of at least one of the plurality of front surface protrusions (e.g., the front surface protrusions **421** of FIG. **4**) may be identical to a central axis of at least one of the plurality of taper protrusions (e.g., the taper protrusions **422** of FIG. **4**).

(95) According to certain embodiments, a difference between a depth of plurality of front surface protrusions (e.g., the first protrusion **421** of FIG. **4**) and a depth of the plurality of taper protrusions (e.g., the second protrusion **422** of FIG. **4**) may be less than or equal to 10 μm .

(96) According to certain embodiments, the plurality of front surface protrusions (e.g., the first protrusion **421** of FIG. **4**) may have a depth of 5 μm to 15 μm , and the plurality of taper protrusions (e.g., the taper protrusion **422** of FIG. **4**) may have a depth of 20 μm to 30 μm .

(97) According to certain embodiments, a ratio between the depth of the plurality of front surface protrusions (e.g., the plurality of front surface protrusions **421** of FIG. **4**) and the depth of the plurality of taper protrusions (e.g., the plurality of front surface protrusions **422** of FIG. **4**) may range from 1:1.5 to 1:4.

(98) According to certain embodiments, a pitch of the plurality of front surface protrusions (e.g., the plurality of front surface protrusions **421** of FIG. **4**) may be an integer multiple of a pitch of the plurality of taper protrusions (e.g., the plurality of taper protrusions **422** of FIG. **4**).

(99) According to certain embodiments, the rear surface (e.g., the rear surface **930** of FIG. **9**) may further include a plurality of taper protrusions (e.g., the taper protrusions **932** of FIG. **9**) protruding from the rear surface protrusions, and the plurality of rear surface protrusions (e.g., the rear surface protrusions **931** of FIG. **9**) and the plurality of taper protrusions (e.g., the taper protrusions **932** of FIG. **9**) protruding from the plurality of rear surface protrusions may be different from each other in at least one of a width, a depth, and a pitch.

(100) According to certain embodiments, the housing (e.g., the electronic device housing **400** of FIG. **4**) may have a transmittance of 50% or greater and a haze value of 30% or less.

(101) According to certain embodiments, the electronic device housing may further include at least one of a paint layer (e.g., the paint layer **470** of FIG. **4**) and a shielding layer (e.g., the shielding layer **480** of FIG. **4**) formed on the deposition layer (the deposition layer **440** of FIG. **4**).

(102) According to certain embodiments, the substrate (e.g., the substrate **410** of FIG. **4**) may include at least one of SAN, PMMA, PC, ABS, PBT, PET, and POM.

(103) FIG. **10** is a cross-sectional view of an electronic device housing according to certain embodiments.

(104) According to certain embodiments, an electronic device housing **1000** may be applied to a rear plate (e.g., the rear plate **111** of FIG. **1**, and the rear plate **380** of FIG. **3**) of an electronic device (e.g., the electronic device **100** of FIG. **1**, and the electronic device **300** of FIG. **3**). According to certain embodiments, when one surface of the electronic device housing **1000** is referred to as a front surface, a surface opposite to the one surface may be referred to as a rear surface.

(105) According to certain embodiments, the terms “front surface” and “rear surface” of the electronic device housing **1000** may be used to indicate one surface and the opposite surface of the electronic device housing **1000**, not a surface facing a predetermined direction of the electronic device housing **1000**.

(106) According to certain embodiments, the electronic device housing **1000** may include a substrate **1010** including a front surface **1020** comprising a plurality of front surface protrusions **1021** and a plurality of taper protrusions **1032** protruding from the plurality of front surface

protrusions, and a rear surface **1030** comprising a plurality of rear surface protrusions **1031**, a deposition layer **1040** formed on the front surface **1020** of the substrate **1010**, and a transparent coating layer **1050** formed on the rear surface **1030** of the substrate **1010**. According to certain embodiments, the deposition layer **1040** may be formed to cover a substantially flat area (that is an area in which a protrusion is not formed) and the front surface protrusions **1021** of the front surface **1020**. The transparent coating layer **1050** may be formed to cover a substantially flat area (that is an area in which a protrusion is not formed), the rear surface protrusions **1031**, and the taper protrusions **1032** of the rear surface **1030**.

(107) According to certain embodiments, a protrusion may be formed to protrude outwardly from an electronic device housing to have a convex shape, and may function as a convex lens by refracting light passing through the electronic device housing.

(108) According to certain embodiments, the transparent coating layer **1050** may be formed to contact the outside to protect the electronic device housing **1000** and the substrate **1010**, and may prevent the electronic device housing **1000** from being corroding, contaminated, scratched, and/or worn away due to an external environment. According to certain embodiments, the transparent coating layer **1050** may be a path through which light enters and exits from the electronic device housing **1000**. According to certain embodiments, a print layer **1060** may be further formed between the transparent coating layer **1050** and the rear surface **1030**. The print layer **1060** may be formed to partially or completely cover the rear surface **1030**, and may be partially formed along the rear surface **1030** based on a pattern, and/or a design the electronic device housing **1000** intends to represent.

(109) According to certain embodiments, the deposition layer **1040** may be formed on the front surface **1020** of the substrate **1010**. According to certain embodiments, at least one of a paint layer **1070** and a shielding layer **1080** may be further formed on the deposition layer **1040**. In FIG. **10**, the deposition layer **1040** may be formed on the front surface **1020** of the substrate **1010**, and the paint layer **1070** and the shielding layer **1080** may be sequentially formed on the deposition layer **1040**. According to certain embodiments, the deposition layer **1040** may be formed to cover the substantially flat area and the front surface protrusions **1021** of the front surface **1020**. According to certain embodiments, either the paint layer **1070** or the shielding layer **1080** may be formed on the deposition layer **1040**, or both the paint layer **1070** and the shielding layer **1080** may be formed. The paint layer **1070** and the order of formation of the shielding layer **1080** may be formed regardless of order.

(110) According to certain embodiments, the deposition layer **1040** formed on the front surface **1020** of the substrate **1010** of the electronic device housing **1000** may include a metal component, for example, various metal materials, such as indium, titanium oxide, aluminum oxide, or silicon oxide, and may provide a sense of beauty by increasing a surface reflectance of the electronic device housing **1000**. According to certain embodiments, the paint layer **1070** may be formed on the deposition layer **1040**. The paint layer **1070**, which is an opaque thin film layer, may implement a color in the electronic device housing **1000**, and may allow a color of the deposition layer **1040** to be shown darker. According to certain embodiments, the shielding layer **1080** may be formed on the deposition layer **1040** or the paint layer **1070** and may perform a shielding function so that an inside of an electronic device (e.g., the electronic device **100** of FIG. **1**, and the electronic device **300** of FIG. **3**) is not visible. According to certain embodiments, the shielding layer **1080** may include various materials for shielding electromagnetic waves (e.g., EMI shielding).

(111) According to certain embodiments, at least one of the front surface protrusions **1021**, the rear surface protrusions **1031**, and the taper protrusions **1032** may have a shape of at least one of a hemisphere, a hexahedron, a cylinder, and a triangular pyramid. According to certain embodiments, a cross section of at least one of the front surface protrusions **1021**, the rear surface protrusions **1031** and the taper protrusions **1032** may have a shape of at least one of a circle, a triangle, a quadrangle, a pentagon, and a hexagon. According to certain embodiments, the shape of at least

one of the front surface protrusions **1021**, the rear surface protrusions **1031**, and the taper protrusions **1032**, or the shape of the cross section thereof may be determined based on a shape of a mold for manufacturing the electronic device housing **1000**, and may also be determined based on an intaglio pattern engraved in the mold by an engraving process.

(112) According to certain embodiments, at least one of the taper protrusions **1032** may be formed from a central portion of the rear surface protrusions **1031**. According to certain embodiments, a central axis of at least one of the rear surface protrusions **1031** may be identical to or coincide with a central axis of at least one of the taper protrusions **1032**. According to certain embodiments, at least one of the taper protrusions **1032** may be formed to include a central axis of at least one of the rear surface protrusions **1031**. According to certain embodiments, at least one of the taper protrusions **1032** may be formed to include a central axis of at least one of the rear surface protrusions **1031**. At least one of the taper protrusions **1032** may be formed to protrude further than the rear surface protrusions **1031**.

(113) According to certain embodiments, a rear surface protrusion **1031** may have a width of 0.01 mm to 1 mm. According to certain embodiments, a width of a taper protrusion **1032** may be less than the width of the rear surface protrusion **1031**. According to certain embodiments, a front surface protrusion **1021** may have a width of 0.01 mm to 1 mm. According to certain embodiments, the width of the front surface protrusion **1021** may be less than the width of the rear surface protrusion **1031**.

(114) According to certain embodiments, a depth of a rear surface protrusion **1031** and a depth of a taper protrusion **1032** may be different from each other. According to certain embodiments, the depth of the taper protrusion **1032** may be greater than the depth of the rear surface protrusion **1031**, and a difference between the depth of the rear surface protrusion **1031** and the depth of the taper protrusion **1032** may be less than or equal to 10 μm . According to certain embodiments, the difference between the depth of the rear surface protrusion **1031** and the depth of the taper protrusion **1032** may desirably be greater than 0 μm and less than or equal to 8 μm .

(115) According to certain embodiments, a rear surface protrusion **1031** may have a depth of 5 μm to 15 μm , and a taper protrusion **1032** may have a depth of 20 μm to 30 μm . According to certain embodiments, the depth of the taper protrusion **1032** may be greater than the depth of the rear surface protrusion **1031**, and an image may be viewed in a magnified state due to interference and refraction of light passing through the rear surface protrusion **1031** and the taper protrusion **1032**.

(116) According to certain embodiments, a ratio between the depth of the rear surface protrusion **1031** and the depth of the taper protrusion **1032** may be range from 1:1.5 to 1:4. According to certain embodiments, the depth of the taper protrusion **1032** may be greater than the depth of the rear surface protrusion **1031**, and an image may be viewed in a magnified state due to interference and refraction of light passing through the rear surface protrusion **1031** and the taper protrusion **1032**.

(117) According to certain embodiments, a pitch of a rear surface protrusion **1031** may be an integer multiple of a pitch of a taper protrusion **1032**. According to certain embodiments, the pitch of the taper protrusion **1032** may be an integer multiple of the pitch of the rear surface protrusion **1031**. According to certain embodiments, each protrusion may be formed so that a central axis of at least one of the rear surface protrusions **1031** may coincide with a central axis of at least one of the taper protrusions **1032**. Since pitches of the rear surface protrusions **1031** and pitches of the taper protrusions **1032** have an integer multiple relationship with each other, all the rear surface protrusions **1031** may be formed to overlap the taper protrusions **1032**, or all the taper protrusions **1032** may be formed to overlap the rear surface protrusions **1031**.

(118) According to certain embodiments, the electronic device housing **1000** may have a transmittance of 50% or greater and a haze value of 30% or less. According to certain embodiments, if the transmittance of the electronic device housing **1000** increases and if the haze value decreases, an amount of light passing through the electronic device housing **1000** may

increase, which may facilitate realizing a visual surface texture by spectroscopy.

(119) According to certain embodiments, the substrate **1010** of the electronic device housing **1000** may be formed of a polymer, for example, a styrene-acrylonitrile (SAN), polymethyl methacrylate (PMMA), polycarbonate (PC), acrylonitrile butadiene styrene (ABS), polybutylene terephthalate (PBT), polyethylene terephthalate (PET), or polyoxymethylene (POM). According to certain embodiments, the electronic device housing **1000** may be transparent or substantially transparent, and may include a translucent material, and light may pass through the transparent coating layer **1050** of the electronic device housing **1000**.

(120) According to certain embodiments, due to interference and refraction of light passing through and/or reflected by the electronic device housing **1000**, an image may be viewed in a magnified state through the electronic device housing **1000**. In particular, due to overlapping of the front surface protrusions **1021**, the rear surface protrusions **1031**, and/or the fourth protrusions, a pattern shape having a sense of perspective may be exhibited.

(121) According to certain embodiments, the substrate **1010** of the electronic device housing **1000** may be formed by injection, and the substrate **1010** may include at least one polymer among styrene-acrylonitrile (SAN), polymethyl methacrylate (PMMA), polycarbonate (PC), acrylonitrile butadiene styrene (ABS), polybutylene terephthalate (PBT), polyethylene terephthalate (PET), and polyoxymethylene (POM). According to certain embodiments, the electronic device housing **1000** may be formed through UV molding. For example, a substrate including the front surface protrusions **1021**, the rear surface protrusions **1031** and the taper protrusions **1032**, and an electronic device housing may be manufactured by a scheme of injecting a UV curable resin into a mold with a pattern, placing a polymer resin on the mold, pressing the polymer resin, irradiating UV rays, and performing UV-curing.

(122) According to certain embodiments, the substrate **1010** may have a curved surface. According to certain embodiments, the substrate **1010** of the electronic device housing **1000** may be injection molded through a mold. For example, a substrate injection molded through a mold with a curved surface may include a curved surface. According to certain embodiments, a plurality of protrusions may also be formed on the curved surface of the substrate **1010** of the electronic device housing **1000**.

(123) According to certain embodiments, the rear surface protrusions **1031** and the taper protrusions **1032** may respectively correspond to the front surface protrusions **421** and the taper protrusions **422** of FIG. 4, and a relationship between the rear surface protrusions **1031** and the taper protrusions **1032** may be the same as or similar to a relationship between the front surface protrusions **421** and the taper protrusions **422** of FIG. 4.

(124) According to certain embodiments, the plurality of rear surface protrusions **1031** and the plurality of taper protrusions **1032** may each have a width, a depth, and a pitch. According to certain embodiments, a depth of each of the rear surface protrusion **1031** and the taper protrusion **1032** may be measured based on an imaginary area or surface extending from an area of the rear surface **1030** in which the rear surface protrusion **1031** and/or the taper protrusion **1032** are not formed. According to certain embodiments, a width of each of the rear surface protrusion **1031** and the taper protrusion **1032** may be measured based on an imaginary line or surface extending from the area of the rear surface **1030** in which the rear surface protrusion **1031** and/or the taper protrusion **1032** are not formed. According to certain embodiments, a pitch of each of the rear surface protrusion **1031** and the taper protrusion **1032** may refer to a minimum distance between protrusions. Here, a width, a depth, and a pitch of protrusions may refer to an average width, an average depth, and an average pitch, respectively.

(125) According to certain embodiments, the rear surface protrusion **1031** and the taper protrusion **1032** may overlap each other. According to an example embodiment, the third protrusion and the fourth protrusion may partially overlap, or may not overlap at all.

(126) According to certain embodiments, the rear surface protrusion **1031** and the taper protrusion

1032 may be different in at least one of a width, a depth, and a pitch.

(127) According to certain embodiments, the front surface protrusion **1021**, the rear surface protrusion **1031**, and the taper protrusion **1032** may be formed to protrude from the substrate **1010** and may have different shapes. According to certain embodiments, two protrusions selected from the front surface protrusions **1021**, the rear surface protrusions **1031**, and the taper protrusions **1032** may be different from each other in at least one of a width, a depth, and a pitch.

(128) According to certain embodiments, the rear surface protrusions **1031** and the taper protrusions **1032** included in the rear surface **1030** of the substrate **1010** may be different in all a width, a depth, and a pitch. More specifically, a pitch of a rear surface protrusions **1031** may be less than or equal to half of a pitch of a taper protrusions **1032**. According to certain embodiments, the pitch of the taper protrusion **1032** may be less than the pitch of the rear surface protrusion **1031**, and the taper protrusion **1032** may be formed so as not to overlap the rear surface protrusion **1031**.

(129) According to certain embodiments, the rear surface protrusions **1031** and the taper protrusions **1032** included in the rear surface **1030** of the substrate **1010** may be different in all a width, a depth, and a pitch. More specifically, a pitch of a taper protrusions **1032** may be greater than or equal to half of a pitch of a rear surface protrusions **1031**. According to certain embodiments, the pitch of the taper protrusion **1032** may be greater than the pitch of the rear surface protrusion **1031**, and the rear surface protrusion **1031** that does not overlap the taper protrusion **1032** at all may be formed.

(130) According to certain embodiments, an electronic device housing (e.g., the electronic device housing **1000** of FIG. **10**) may include a substrate (e.g., the substrate **1010** of FIG. **10**), a front surface (e.g., the front surface **1020** of FIG. **10**) may comprise a plurality of front surface protrusions (e.g., the front surface protrusions **1021** of FIG. **10**), and the rear surface (e.g., the rear surface **1030** of FIG. **10**) may comprises a plurality of rear surface protrusions (e.g., the rear surface protrusions **1031** of FIG. **10**), and a plurality of taper protrusions (e.g., the taper protrusions **1032** of FIG. **10**) protruding from the rear surface protrusions. Two protrusions selected from the plurality of front surface protrusions, rear surface protrusions, and taper protrusions are different from each remaining one of the plurality of front surface protrusions, plurality of rear surface protrusions, and plurality of taper protrusions. The electronic device housing may also include a deposition layer (e.g., the deposition layer **1040** of FIG. **10**) formed on the front surface (e.g., the front surface **1020** of FIG. **10**) of the substrate, and a transparent coating layer (e.g., the transparent coating layer **1050** of FIG. **10**) formed on the rear surface (e.g., the rear surface **1030** of FIG. **10**) of the substrate.

(131) According to certain embodiments, a central axis of at least one of the plurality of rear surface protrusions (e.g., the plurality of rear surface protrusion **1031** of FIG. **10**) may be identical to a central axis of at least one of the plurality of taper protrusions (e.g., the plurality of taper protrusion **1032** of FIG. **10**).

(132) According to certain embodiments, a difference between a depth of a plurality of rear surface protrusions **1031** (e.g., the plurality of rear surface protrusions **1031** of FIG. **10**) and a plurality of taper protrusions (e.g., the taper protrusion **1032** of FIG. **10**) protruding from the plurality of rear surface protrusions may be less than or equal to 10 μm .

(133) According to certain embodiments, a ratio between the depth of the plurality of rear surface protrusions **1031** (e.g., the rear surface protrusion **1031** of FIG. **10**) and the depth of the plurality of taper protrusions (e.g., the taper protrusion **1032** of FIG. **10**) may range from 1:1.5 to 1:4.

(134) According to certain embodiments, a pitch of the plurality of rear surface protrusions (e.g., the plurality of rear surface protrusions **1031** of FIG. **10**) may be an integer multiple of a pitch of the plurality of taper protrusions (e.g., the taper protrusion **1032** of FIG. **10**).

(135) According to certain embodiments, the electronic device housing may further include at least one of a paint layer (e.g., the paint layer **1070** of FIG. **10**) and a shielding layer (e.g., the shielding layer **1080** of FIG. **10**) formed on the deposition layer (e.g., the deposition layer **1040** of FIG. **10**).

(136) The electronic device according to certain embodiments may be enclosed by an electronic device housing. According to certain embodiments, the electronic device housing may be a front plate (e.g., the front plate **102** of FIG. **1**) or a rear plate (e.g., the rear plate **111** of FIG. **2**) of the electronic device. The electronic device enclosed by the electronic device housing may refer to an electronic device including an electronic device housing on at least one surface thereof.

(137) According to certain embodiments, an electronic device housing (e.g., the electronic device housing **400** of FIG. **4**) enclosing an electronic device may include a substrate (e.g., the substrate **410** of FIG. **4**), the substrate may include a front surface comprising a plurality of front surface protrusions (e.g., the plurality of front surface protrusions **421** of FIG. **4**) and a plurality of taper projections (e.g., the plurality of taper protrusions **422** of FIG. **4**), and a rear surface comprising a plurality of rear surface protrusions (e.g., the rear surface protrusions **431** of FIG. **4**). Two protrusions selected from the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions may be different from each remaining one of the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions, in at least one of a width, a depth, and a pitch. The electronic device housing may further include a deposition layer (e.g., the deposition layer **440** of FIG. **4**) formed on a front surface (e.g., the front surface **420** of FIG. **4**) of the substrate, and a transparent coating layer (e.g., the transparent coating layer **450** of FIG. **4**) formed on a rear surface (e.g., the rear surface **430** of FIG. **4**) of the substrate.

(138) According to certain embodiments, the rear surface of the electronic device housing enclosing the electronic device may further include a plurality of taper protrusions protruding from the plurality of rear surface protrusions.

(139) According to certain embodiments, a pattern formed by refraction and interference of light between the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions is shown on a surface of the electronic device housing.

(140) FIGS. **11A** through **11C** illustrate actual images of an electronic device to which an electronic device housing is applied, according to certain embodiments.

(141) Referring to FIGS. **11A** through **11C**, a pattern formed by refraction and interference of light between first protrusions, second protrusions and third protrusions may be shown on a surface of the electronic device housing. According to an example embodiment, the electronic device housing may function as a plate forming a rear surface of an electronic device, may magnify an image, in a similar manner to a convex lens, due to refraction and/or interference of light by the first protrusions, the second protrusions, and the third protrusions included in the electronic device housing, and may form various types of patterns. In particular, the first protrusions and the second protrusions may be formed to partially overlap, and a pattern formed by a difference in depth between the first protrusions and the second protrusions may allow a user to feel a sense of perspective.

(142) According to certain embodiments, the rear surface of the substrate of the electronic device housing may further include a plurality of fourth protrusions (e.g., the taper protrusions **932** of FIG. **9**). According to certain embodiments, the electronic device may be at least one of a portable electronic device (e.g., a smartphone, a tablet PC, or a laptop) and a wearable electronic device (e.g., a smart watch).

(143) FIG. **12** is a flowchart illustrating a method of manufacturing an electronic device housing according to certain embodiments.

(144) Referring to FIG. **12**, the method of manufacturing an electronic device housing may include operation **1210** of preparing a mold, operation **1220** of injection molding a housing using the mold, operation **1230** of forming a transparent coating layer on one surface of the housing, and operation **1240** of forming at least one of a deposition layer, a paint layer, and a shielding layer on an opposite surface of the housing.

(145) According to certain embodiments, the mold prepared by operation **1210** of preparing the

mold may include a plurality of patterns. According to certain embodiments, the mold may include a first surface, and a second surface corresponding to the first surface. The first surface may include two or more patterns, for example, a first pattern and a second pattern, and the second surface may include a third pattern.

(146) According to certain embodiments, the pattern included in the mold may be formed in an intaglio shape, and the electronic device housing formed by injection may have an embossed protrusion on a surface thereof. According to certain embodiments, the first surface of the mold may be formed by overlapping two or more patterns (e.g., a first pattern and a second pattern), and the two or more patterns may be different in at least one of a width, a depth, and a pitch. According to certain embodiments, the first pattern and the second pattern may include a plurality of dimples or a plurality of slits. In an area in which the first pattern and the second pattern overlap, an additional dimple may be formed on the dimples.

(147) According to certain embodiments, the second surface of the mold may further include a fourth pattern overlapping the third pattern in addition to the third pattern. According to certain embodiments, the second surface of the mold may be formed by overlapping two or more patterns (e.g., a third pattern and a fourth pattern), and the two or more patterns may be different in at least one of a width, a depth, and a pitch. According to certain embodiments, the third pattern and the fourth pattern may include a plurality of dimples or a plurality of slits. In an area in which the third pattern and the fourth pattern overlap, an additional dimple may be formed on the dimples.

(148) According to certain embodiments, the first pattern, the second pattern, and the third pattern may be formed by an engraving process. According to certain embodiments, the engraving process may refer to engraving a pattern of a specific shape on a mold using a tool, and a shape of the pattern engraved on the mold may be determined based on a shape of the tool. According to certain embodiments, the first pattern, the second pattern, and/or the third pattern may have a shape of at least one of a hemisphere, a hexahedron, a cylinder, and a triangular pyramid.

(149) According to certain embodiments, operation **1220** of injection molding the housing may manufacture the electronic device housing on which a plurality of intaglio patterns engraved in the mold are transferred. According to certain embodiments, a housing or a substrate of the housing may be formed by injecting at least one polymer resin among SAN, PMMA, PC, ABS, PBT, PET, and POM into a mold, and may further include a UV curable resin to use UV molding for performing curing when UV rays are irradiated.

(150) According to certain embodiments, operation **1240** of forming at least one of the deposition layer, the paint layer, and the shielding layer on the opposite surface of the housing may be performed on the opposite surface of the housing on which the transparent coating layer is formed. According to certain embodiments, the deposition layer, the paint layer, and the shielding layer may be formed regardless of order. According to an example embodiment, the deposition layer, the paint layer, and the shielding layer may be sequentially formed.

(151) According to certain embodiments, the method may further include, after operation **1240** of forming at least one of the deposition layer, the paint layer, and the shielding layer on the opposite surface of the housing, an operation of computerized numerical control (CNC)-machining the housing.

(152) FIG. **13** is a perspective view of a mold for manufacturing an electronic device housing according to certain embodiments.

(153) Referring to FIG. **13**, molds **1310** and **1320** may be prepared to manufacture an electronic device housing **1300**. According to certain embodiments, a mold may include a first mold **1310** for manufacturing a front surface of the electronic device housing **1300** and a second mold **1320** for manufacturing a rear surface of the electronic device housing **1300**. According to certain embodiments, the first mold **1310** may include a first surface for manufacturing the front surface of the electronic device housing **1300**, and the second mold **1320** may include a second surface for manufacturing the rear surface of the electronic device housing **1300**.

(154) According to certain embodiments, the first surface of the first mold **1310** may include two or more patterns, for example, a first pattern **1311** and a second pattern **1312**. According to certain embodiments, the second surface of the second mold **1320** may include a third pattern **1321**. According to certain embodiments, the electronic device housing **1300** may be molded by injecting a polymer resin between the first mold **1310** and the second mold **1320**.

(155) According to certain embodiments, the first pattern **1311**, the second pattern **1312**, and/or the third pattern **1321** may be formed in an intaglio shape, or may be formed in a hemispherical shape or a dimple shape. According to certain embodiments, the first pattern **1311** and the second pattern **1312** may partially overlap. In an area in which the first pattern **1311** and the second pattern **1312** overlap, an additional dimple may be formed on the dimples. According to certain embodiments, protrusions formed through the first pattern **1311**, the second pattern **1312**, and the third pattern **1321** may respectively correspond to the first protrusions (e.g., the front surface protrusions **421** of FIG. 4), the second protrusions (e.g., the taper protrusions **422** of FIG. 4), and the third protrusions (e.g., the rear surface protrusions **431** of FIG. 4) of the above-described electronic device housing (e.g., the electronic device housing **400** of FIG. 4).

(156) FIGS. **14A** through **14D** illustrate images obtained by capturing a surface of a mold according to certain embodiments.

(157) According to certain embodiments, the mold may include two or more patterns (e.g., the first pattern **1311** and the second pattern **1312** of FIG. **13**). According to certain embodiments, a first pattern and a second pattern may be different from each other in at least one of a width, a depth, and a pitch, and a central axis of the first pattern and a central axis of the second pattern may be identical to or coincide with each other (FIGS. **14A**, **14B**, and **14C**). According to certain embodiments, a pitch of the first pattern may be an integer multiple of a pitch of the second pattern. A central axis of at least one of first patterns may coincide with or substantially coincide with a central axis of at least one of second patterns (FIG. **14D**).

(158) The electronic device according to certain embodiments may be one of various types of electronic devices. The electronic device may include, for example, a portable communication device (e.g., a smartphone), a computer device, a portable multimedia device, a portable medical device, a camera, a wearable device, or a home appliance device. According to an example embodiment of the disclosure, the electronic device is not limited to those described above.

(159) It should be appreciated that certain embodiments of the present disclosure and the terms used therein are not intended to limit the technological features set forth herein to particular example embodiments and include various changes, equivalents, or replacements for a corresponding example embodiment. Moreover, components of the foregoing embodiments, can be omitted, substituted, or supplemented without departing from the scope of this document. In connection with the description of the drawings, like reference numerals may be used for similar or related components. It is to be understood that a singular form of a noun corresponding to an item may include one or more of the things, unless the relevant context clearly indicates otherwise. As used herein, “A or B”, “at least one of A and B”, “at least one of A or B”, “A, B or C”, “at least one of A, B and C”, and “A, B, or C,” each of which may include any one of the items listed together in the corresponding one of the phrases, or all possible combinations thereof. Terms such as “first”, “second”, or “first” or “second” may simply be used to distinguish the component from other components in question, and may refer to components in other aspects (e.g., importance or order) is not limited. It is to be understood that if an element (e.g., a first element) is referred to, with or without the term “operatively” or “communicatively”, as “coupled with,” “coupled to,” “connected with,” or “connected to” another element (e.g., a second element), it means that the element may be coupled with the other element directly (e.g., wiredly), wirelessly, or via a third element.

Claims

1. An electronic device housing comprising: a substrate including: a front surface comprising a plurality of front surface protrusions and a plurality of taper protrusions protruding from the plurality of front surface protrusions and a rear surface comprising a plurality of rear surface protrusions; and wherein two protrusions selected from the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions are different from each remaining ones of the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions; a deposition layer formed on the front surface of the substrate; and a transparent coating layer formed on the rear surface of the substrate, a print layer formed between the transparent coating layer and the rear surface and partially or completely covering the rear surface, wherein tips of the plurality of taper protrusion comprise round shape.
2. The electronic device housing of claim 1, wherein at least one of the plurality of front surface protrusions, the plurality of taper protrusions and the plurality of rear surface protrusions has a shape of at least one of a hemisphere, a hexahedron, a cylinder, and a triangular pyramid.
3. The electronic device housing of claim 1, wherein a central axis of at least one of the plurality of front surface protrusions is identical to a central axis of at least one of the plurality of taper protrusions.
4. The electronic device housing of claim 1, wherein each of the plurality of front surface protrusions has a depth of 5 μm to 15 μm , and each of the plurality of taper protrusions has a depth of 20 μm to 30 μm .
5. The electronic device housing of claim 1, wherein a ratio between a depth of each of the plurality of front surface protrusions and a depth of each of the plurality of taper protrusions ranges from 1:1.5 to 1:4.
6. The electronic device housing of claim 1, wherein a pitch of each of the plurality of front surface protrusions is an integer multiple of a pitch of each of the plurality of taper protrusions.
7. The electronic device housing of claim 1, wherein the rear surface further comprises another plurality of taper protrusions protruding from the plurality of rear surface protrusions, and the plurality of rear surface protrusions and the another plurality of taper protrusions are different from each other in at least one of a width, a depth, and a pitch.
8. The electronic device housing of claim 1, wherein the electronic device housing has a transmittance of 50% or greater and a haze value of 30% or less.
9. The electronic device housing of claim 1, further comprising: at least one of a paint layer and a shielding layer formed on the deposition layer.
10. The electronic device housing of claim 1, wherein the substrate comprises at least one selected from a group consisting of styrene-acrylonitrile (SAN), polymethyl methacrylate (PMMA), polycarbonate (PC), acrylonitrile butadiene styrene (ABS), polybutylene terephthalate (PBT), polyethylene terephthalate (PET), and polyoxymethylene (POM).
11. An electronic device housing comprising: a substrate including: a front surface comprising a plurality of front surface protrusions; and a rear surface comprising a plurality of rear surface protrusions and a plurality of taper protrusions protruding from the plurality of rear surface protrusions; and wherein two protrusions selected from the plurality of front surface protrusions, rear surface protrusions, and taper protrusions are different from each remaining one of the plurality of front surface protrusions, plurality of rear surface protrusions, and plurality of taper protrusions; and a deposition layer formed on the front surface of the substrate; and a transparent coating layer formed on the rear surface of the substrate, a print layer formed between the transparent coating layer and the rear surface and partially or completely covering the rear surface, wherein tips of the plurality of taper protrusion comprise round shape.
12. The electronic device housing of claim 11, wherein a central axis of at least one of the plurality of rear surface protrusions is identical to a central axis of at least one of the plurality of taper protrusions.

13. The electronic device housing of claim 11, wherein a ratio between a depth of each of the plurality of rear surface protrusions and a depth of each of the plurality of taper protrusions ranges from 1:1.5 to 1:4.

14. The electronic device housing of claim 11, wherein a pitch of each of the plurality of rear surface protrusions is an integer multiple of a pitch of each of the plurality of taper protrusions.

15. The electronic device housing of claim 11, further comprising: at least one of a paint layer and a shielding layer formed on the deposition layer.

16. An electronic device enclosed by an electronic device housing, wherein the electronic device housing comprises: a substrate including: a front surface comprising a plurality of front surface protrusions and a plurality of taper protrusions protruding from the plurality of front surface protrusions, and a rear surface comprising a plurality of rear surface protrusions; and wherein two protrusions selected from the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions are different from remaining ones of the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions; a deposition layer formed on the front surface of the substrate; and a transparent coating layer formed on the rear surface of the substrate, a print layer formed between the transparent coating layer and the rear surface and partially or completely covering the rear surface, wherein tips of the plurality of taper protrusion comprise round shape.

17. The electronic device of claim 16, wherein the rear surface further comprises a another plurality of taper protrusions protruding from the plurality of rear surface protrusions.

18. The electronic device of claim 16, wherein a pattern formed by refraction and interference of light between the plurality of front surface protrusions, the plurality of taper protrusions, and the plurality of rear surface protrusions is shown on a surface of the electronic device housing.
