

PRECIOUS METAL ARTICLE WITH PLATING LAYER ON SURFACE AND PREPARATION METHOD THEREOF

FIELD

[0001] The present disclosure relates to the field of a plating layer on the precious metal surface, specifically relates to a precious metal article with a plating layer on the surface and a preparation method thereof.

BACKGROUND

[0002] The gold products have the characteristics of bright color and desirable stability, are usually used as the ornaments and jewelry and are popular among widespread consumers. The current production process of the gold product mainly comprises casting a wax mold, inverting a mold, surface trimming and shape-correction treatment. In order to improve glossiness of a surface of the gold product, the surface of the gold product is generally treated with an electroplating method.

[0003] CN106521594A discloses a processing method and device for processing K gold into gold natural color, the processing method comprises the following steps: manufacturing semi-finished jewelry products in advance; subjecting the semi-finished jewelry products to electroplating processing, so as to convert the external color of the semi-finished jewelry products to the gold natural color; and carrying out

surface treatment on the electroplated semi-finished jewelry products to form the finished jewelry products. However, when the electroplating method is adopted to plate a film on the surface of the gold product, the film layer on the surface of the gold product is unstable and is prone to peel off.

[0004] CN107675136A discloses a method for physical vapor deposition (PVD) film coating on surfaces of workpieces, the method comprises the following steps: putting workpieces to be plated in a film plating chamber, vacuumizing and heating the film plating chamber, then introducing argon gas, performing ion bombardment treatment on the workpieces to be plated; then introducing a working gas, applying a bias voltage to the workpieces to be plated, and depositing the plating layers with corresponding materials on the surfaces of the workpieces to be plated.

[0005] CN105803412A discloses a PVD coating on surface of airspeed head and a preparation method of PVD coating, wherein the method comprises a step of depositing a single metal plating layer on the polished surface of the airspeed head by using the physical vapor deposition method.

[0006] The aforementioned methods adopt a PVD method to plate a film on the surface of the workpiece, thereby improving the bonding force between the plating film and the workpiece to be plated. However, PVD is only suitable for plating a film on the surface of a material with a high

hardness at present, when the plating film is attached to a surface of the material with a low hardness (e.g., Mohs hardness of 2-3), the bonding force between the film layer and the substrate is still weak.

SUMMARY

[0007] The present disclosure aims to overcome the problems in the art with respect to unstable plating layer on the precious metal surface and low glossiness of the plating layer, and provides a precious metal article having a plating layer on the surface and a preparation method thereof, the method can be utilized to form a transparent film layer on the surface of the precious metal article, the formed transparent film layer has a stable structure and strong abrasion resistance, and is capable of imparting a permanent colorfastness to the precious metal article.

[0008] In order to achieve the above object, a first aspect of the present disclosure provides a precious metal article, wherein the precious metal article comprises a precious metal base and a transparent film layer attached on the precious metal base, the precious metal is gold or silver.

[0009] In a second aspect, the present disclosure provides a method for preparing the aforementioned precious metal article, wherein the method comprises: depositing a transparent film layer on the surface of a precious metal base.

[0010] Through the above-mentioned technical solution, the color of the

produced precious metal article is durable without fading. In a preferred embodiment, the precious metal base is subjected to a surface Pre-treatment to improve roughness of the surface of the precious metal base, then it is easier to form a transparent film layer on the surface of the precious metal base by using PVD, and the formed film layer exhibits the improved properties that it is more stable and has stronger abrasion resistance, and the color of the precious metal article can be more durable with colorfastness.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 illustrates a schematic view of the structure of the precious metal article of Example 1.

DESCRIPTION OF THE REFERENCE NUMERALS

[0012] 1. Precious metal base

[0013] 2.Transparent film layer

DETAILED DESCRIPTION

[0014] The terminals and any value of the ranges disclosed herein are not limited to the precise ranges or values, such ranges or values shall be comprehended as comprising the values adjacent to the ranges or values. As for numerical ranges, the endpoint values of the various ranges, the

endpoint values and the individual point values of the various ranges, and the individual point values may be combined with one another to produce one or more new numerical ranges, which should be deemed have been specifically disclosed herein.

[0015] In a first aspect, the present disclosure provides a precious metal article, as shown in FIG. 1, wherein the precious metal article comprises: a precious metal base 1 and a transparent film layer 2 attached on the precious metal base 1 (it is preferable that the precious metal article is consisting of a precious metal base 1 and a transparent film layer 2 attached on the precious metal base 1), the precious metal is gold or silver.

[0016] According to the present disclosure, The precious metal base 1 may have a precious metal content of 33-99.99 wt%, preferably 75-99.99 wt% (or 99-99.99 wt%); for example, the precious metal base 1 in the present disclosure may be K gold or pure gold; wherein K gold refers to the precious metal base 1 formed by melting gold in admixture with silver, zinc, copper, palladium or nickel; the pure gold means that the precious metal base 1 has a gold content not less than 99 wt%; in the present disclosure, the pure gold comprises 3D hard gold.

[0017] According to the present disclosure, the silver may have a silver content within a range of 92.5-99 wt%.

[0018] According to the present disclosure, the surface roughness of the

precious metal base 1 is preferably within a range of 0.001-50 μm , more preferably 0.005-0.1 μm . In the present disclosure, the surface roughness is denoted as Ra, which means the unevenness of the small spacing, tiny peak and valley of the processed surface, and can be directly tested with a surface roughness measuring instrument.

[0019] In the present disclosure, if the raw material per se of the precious metal base 1 satisfies the aforementioned definition of the surface roughness, the subsequent steps may be directly performed. If the precious metal base 1 is made of a material that does not satisfy the aforementioned definition of the surface roughness, the precious metal base 1 may be treated through a chemical or mechanical method, which is not particularly limited in the present disclosure, as long as the above roughness can be satisfied.

[0020] In the present disclosure, if the surface roughness of the precious metal base 1 satisfies the above conditions, it is easier to perform film plating on the surface of the precious metal base. If the surface roughness is too low, the bonding firmness between the film layer and the precious metal base is reduced; if the surface roughness is too large, the color and luster of the finally produced precious metal article are affected.

[0021] According to the present disclosure, the thickness of the transparent film layer 2 may be within a range of 0.0001-10 μm (e.g., 0.0001 μm , 0.0002 μm , 0.001 μm , 0.006 μm , 0.01 μm , 0.09 μm , 0.1 μm ,

0.2 μ m, 1 μ m, 10 μ m, or any value therebetween), preferably 0.0005-0.1 μ m, more preferably 0.005-0.1 μ m. In the present disclosure, the material of the transparent film layer 2 is preferably a fluoride; for example, the fluoride may be an AF pill; in the present disclosure, the AF pill is commercially available; for example, from Huizhou Momet electronic Technology Co., Ltd., with a model number TS-2AB.

[0022] The present disclosure defines the thickness and material of the transparent film layer 2 within the above ranges, on one hand, it is able to prevent oxidation of the formed film layer, such that the film layer is more stable; on the other hand, it serves to increase abrasion resistance, and allows the formed color to be more durable without fading. In the present disclosure, especially when the formed film layer has a rose gold color, since the target material in use contains copper which is prone to oxidize, the application of the AF film thereon can prevent oxidation and produce a protective effect.

[0023] In the present disclosure, the precious metal article 1 may have a glossiness of 880-950Gu, preferably 880-900Gu, when the glossiness is measured at an angle of 60°. In the present disclosure, Gu means an English term “gloss unit”, and 1 gloss unit = 1 Gu.

[0024] In a second aspect, the present disclosure provides a method for preparing the aforementioned precious metal article, wherein the method comprises: depositing a transparent film layer 2 on the surface of a

precious metal base 1 by physical vapor deposition.

[0025] According to the present disclosure, the physical vapor deposition mode may be vacuum evaporation plating, vacuum sputter coating or vacuum ion plating.

[0026] Preferably, the physical vapor deposition mode is vacuum ion plating.

[0027] According to the present disclosure, if the vacuum evaporation plating is adopted, the vacuum evaporation plating mode comprises: activating the current of the evaporation source to evaporate the fluoride to form the transparent film layer 2.

[0028] Preferably, the vacuum evaporation plating mode includes: performing evaporation for 170-190s under the condition that the current of the evaporation source is within a range of 700-750A; further performing evaporation for 170-190s under the condition that the current of the evaporation source is within a range of 750-800A; subsequently performing evaporation for 410-430s under the condition that the current of the evaporation source is within a range of 800-900A. More specifically, the vacuum evaporation plating mode comprises: adjusting the vacuum degree to 1.8×10^{-2} - 2.2×10^{-2} Pa, enabling the intra-furnace environment to be suitable for electroplating, injecting argon gas with an gas flow of 55-65sccm, adjusting the vacuum degree to 1.3×10^0 - 1.7×10^0 Pa, performing glow cleaning for 170-190s, injecting

oxygen gas with an oxygen gas flow rate of 75-85sccm, adjusting the vacuum degree to 3.8×10^{-4} - 4.2×10^{-4} Pa, activating the aluminum target and the silicon target and operating for 80-100s and 170-190s respectively, and then shutting off the power sources of the aluminum target and the silicon target, activating the power supply of the evaporation source, setting the silicon target current to be within a range of 2.8-3.2A; performing evaporation for 170-190s under the condition that the current of the evaporation source is within a range of 700-740A; further performing evaporation for 170-190s under the condition that the current of the evaporation source is within a range of 750-800A; subsequently performing evaporation for 410-430s under the condition that the current of the evaporation source is within a range of 800-900A; thereby forming a transparent film layer having a thickness within a range of 0.0001-10 μ m, particularly 0.1-10nm.

[0029] In addition, the vacuum evaporation plating is performed under the conditions consisting of a normal temperature, a vacuum degree of 3×10^{-4} Pa- 6×10^{-4} Pa, an argon gas flow of 50-60sccm, an oxygen gas flow rate of 70-80sccm, an applied bias voltage of 30-40V, a duty ratio of 30-40% and a time of 20-30min; the target materials are an aluminum target, a silicon target, and the current is 2-3A when the aluminum target is selected, and the current is 2-3A when the silicon target is selected.

[0030] The present disclosure uses the principle of the vacuum

evaporation plating, namely a solid material is placed in a vacuum chamber, the solid material is subjected to evaporation and heating under a vacuum condition, the evaporated atoms or molecules can be freely dispersed on the walls of the container. In the present disclosure, when a precious metal base 1 is placed in the vacuum chamber, the evaporated atoms or molecules will adsorb onto the precious metal base 1 to form a thin film. A method of the vacuum evaporation plating is utilized in the present disclosure, a fluoride is evaporated by heating in a vacuum so that the fluoride is deposited on the surface of the metal base 1.

[0031] According to the present disclosure, if the vacuum ion plating is adopted, the vacuum ion plating comprises the following steps: heating the precious metal base 1 under the vacuum condition, activating a metal target, and injecting gas, loading a bias voltage, and perform film plating on the surface of the precious metal base 1;

[0032] among these, when the heating temperature is within a range of 50-260 °C under the vacuum conditions consisting of a vacuum degree of 1×10^{-2} Pa- 9.5×10^{-3} Pa, the temperature will influence the bonding force between the plating layer and the precious metal base 1 and the color of the plating layer, especially during a process of producing a rose gold color, the heating temperature in the furnace is generally within a range of 100-250 °C, preferably 200 °C.

[0033] Wherein the time of plating film is within a range of 2-2,000min,

the deposition time in the present disclosure has a characteristic that the time of plating film is various according to the different target material and the color to be plated; the target materials are divided into an arc target, a column target and a flat target, the ion particles of the arc target are the coarsest, followed by the ion particles of the flat target, the ion particles of the column target are the finest, as a result, the arc target can be quickly colored, followed by the flat target, the column target is slowly colored, taking rose gold color as an example, the plating time of the arc target is about 10min, the plating time of the column target is 20-30min; in addition, the time of plating the magic color film is about 10min, the time of plating a purple film is the shortest, such as 2-3min, thus the purple plating layer has a large color difference and a unstable color.

[0034] Wherein the metal used in the metal target is one or more selected from the group consisting of nickel, zinc, magnesium, tin, iron, chromium, silicon, copper, titanium, zirconium, molybdenum, tungsten, aluminum, niobium, indium, tantalum, germanium, silver, gold, cobalt, gadolinium, lanthanum, yttrium, cerium, hafnium, tungsten, stainless steel, and alloys or oxides, nitrides, carbides, fluorides, sulfides, gold copper alloys and borides thereof; preferably gold copper alloys.

[0035] Wherein the gas comprises a protective gas and a toning gas, the protective gas is an inert gas, and the toning gas is one or more selected from the group consisting of nitrogen gas, acetylene, methane and oxygen

gas; it is preferable in the present disclosure that the argon gas is used as protective gas, the argon gas is utilized for adjusting the vacuum degree, the gas flow of the protective gas is within a range of 20-200sccm, preferably 20-150sccm; it is preferable in the present disclosure that the nitrogen gas, acetylene, methane or oxygen gas are used for adjusting color of the plating layer, the gas flow rate of the toning gas is within a range of 50-500sccm.

[0036] Wherein the applied bias voltage is 10-150V, and the duty ratio is 10-80%. In the present disclosure, the term “duty ratio” refers to the ratio of the time occupied by pulses relative to the total time during a period of continuous operation. In the present disclosure, the higher is the bias voltage, the larger is the brightness; however, if the bias voltage exceeds a certain value, the edge of the precious metal article will turn yellow; thus the effect is optimal when the applied bias voltage is defined in the above range.

[0037] Wherein the target material current of the metal target is as follows: the current of column target is within a range of 3-120A, preferably 10-120A, more preferably 20-120A, the current of arc target is within a range of 50-200A. In the present disclosure, the larger is the current, the coarser are the ion particles, which results in the hazy plating layer on the surface of the precious metal article, that is, the glossiness is undesirable, especially the current of arc target has the largest influence

on the glossiness, the current of the column target has a slightly small influence on the glossiness, the suitable current is vital for the glossiness of the plating layer. Therefore, when the current of the target material is limited to the above range, it produces the best effect.

[0038] According to the present disclosure, if the vacuum sputtering coating is adopted, the precious metal base 1 is heated to a temperature of 100-250 °C under a vacuum degree of 1×10^{-2} Pa- 7×10^{-3} Pa, and the surface oxide film is removed from the metal target to be plated. Under the condition of plasma, positive ions formed after argon ionization bombard the surface of the target material, the magnetron sputtering is used for plating film on the surface of the precious metal base, the sputtering voltage is selected within a range of 300-700V, and the metal to be plated forms a thin film on the surface of the precious metal base.

[0039] According to the present disclosure, the metal target and the gas may be selected according to the color shown by the finally produced precious metal article. For example, taking the precious metal article showing the rose gold color as an example, the metal target may be a gold copper target or a TiAl column target, and the gas may be nitrogen gas. The concrete details may be specifically formulated in the examples.

[0040] According to the present disclosure, the method further comprises conducting an intra-furnace vacuumization process prior to depositing a transparent film layer 2 on the surface of the precious metal base 1,

wherein the vacuum degree during the intra-furnace vacuumization process is within a range of $1 \times 10^{-2} \text{Pa}$ - $7 \times 10^{-3} \text{Pa}$ according to the requirements of the plating film color and the target material; in order to ensure a clean intra-furnace vacuum environment such that the intra-furnace environment is suitable for vacuum sputter coating; the requirement on the intra-furnace vacuum degree varies depending on the produced precious metal article, and the vacuumization time is generally within a range of 0.5-2 hours.

[0041] According to the present disclosure, the glow cleaning is implemented prior to the physical vapor deposition, and the glow cleaning conditions comprise: the gas flow rate of the argon gas is within a range of 100-320sccm, preferably 280-320sccm, the applied bias voltage is within a range of 380-1,000V, preferably 380-420V, and the duty ratio is 10-80%, preferably 48-52%; the time is 160-720s, preferably 160-200s.

[0042] According to the present disclosure, the method further comprises cleaning the surface of the precious metal base 1.

[0043] In the present disclosure, different cleaning methods can be selected depending on the surface structure, area and cleanliness degree of the precious metal base 1. Generally, there are two kinds of cleaning methods.

[0044] The first method comprises the following steps: ultrasonically

washing the precious metal base 1 for 1-15min under the condition of ultrasonic frequency 20-30kHz; it should be noted in the present disclosure that the ultrasonic cleaning time can be prolonged under the special conditions, after the ultrasonic cleaning is finished, the precious metal base shall be washed with clean water for more than 6 times to remove residues of the surface detergent; after the washing process is finished, the baking treatment needs to be carried out for dehydration and roasting.

[0045] The second method comprises the following steps: if the surface of the precious metal base 1 is clean, there is not an oxide layer, the ultrasonic cleaning is not required, a surface of the precious metal base 1 may be directly wiped with 95-98 wt% of alcohol.

[0046] In the present disclosure, the cleaning method may be the first method and/or the second method, and preferably, the cleaning method may be the first method and the second method.

[0047] In the present disclosure, the precious metal base 1 is subjected to ultrasonic treatment and/or washing with alcohol under the above conditions, so that the bonding force between the transparent film layer 2 and the precious metal base 1 can be further improved. In addition, a film layer with the thickness of 10nm-50 μ m can be formed on the surface of the precious metal base within a short time, and the formed film layer is more stable.

[0048] According to the present disclosure, the method further comprises a step of baking the ultrasonically treated precious metal base 1, the baking temperature is 100-150 °C, and the baking time is 5-30min.

[0049] Wherein, the surface treatment method of the precious metal base 1 is not particularly limited herein, and a physical polishing or a chemical etching method may be employed, as long as the condition that the surface roughness of the precious metal base 1 is within a range of 0.001-50μm, preferably 0.005-0.1μm can be achieved.

[0050] The present disclosure will be described in detail with reference to examples.

[0051] In the following examples and comparative examples:

[0052] Glossiness: the glossiness of the precious metal articles was measured with a LS192 glossiness instrument at an angle of 60 °.

[0053] Abrasion resistance: the WS-97 coating adhesive force scratch tester developed by the Zhongke Kaihua Technology Development Co., Ltd. was adopted to carry out scratch test on the precious metal article. The scratch test used a scribe with a smooth conical tip to carve the surface of the coating under the gradually increasing load until the coating was damaged, and the load applied when the coating was damaged was a critical load, which was taken as the measurement of the adhesive strength of the plating layer and the base. The loading rate was set to 10N/min, the applied load was set to 30N, the scratch speed was set

to 2mm/min, and the scratch length was 5 mm.

[0054] Example 1

[0055] The present example served to prepare a pure gold article plated with a transparent film layer using the method of the present disclosure.

[0056] (1) Pre-treatment

[0057] Selection of a precious metal base 1: the pure gold was selected as the material of a precious metal base 1, which had a surface roughness of 0.02 μ m;

[0058] Cleaning: ultrasonically cleaning the pure gold for 10min by using distilled water under the ultrasonic frequency condition of 20kHz, the pure gold after subjecting to ultrasonic cleaning was baked at 150 $^{\circ}$ C for 30min; then the surface was wiped and cleaned with a dust-free fabric dipped in 98 wt% alcohol;

[0059] Vacuumization of the furnace: the baked pure gold was placed into a vacuum furnace, and the vacuum degree was adjusted to 3×10^{-3} Pa in order to ensure the clean vacuum environment in the furnace and the intra-furnace environment was suitable for electroplating.

[0060] (2) Deposition of transparent film layer

[0061] The pure gold was placed in a vacuum furnace, and subjected to film plating under the room temperature by means of a vacuum evaporation plating mode, wherein the vacuum degree was adjusted to 2.0×10^{-2} Pa such that the intra-furnace environment was suitable for

electroplating, the argon gas was injected with the gas flow of 60sccm; the vacuum degree was adjusted to $1.5 \times 10^0 \text{Pa}$, the glow cleaning was performed for 180s under the conditions consisting of an argon gas flow of 300sccm, an applied bias voltage of 400V and a duty ratio of 50%; the oxygen gas was injected with a gas flow of 80sccm, the vacuum degree was adjusted to $4.0 \times 10^{-1} \text{Pa}$, the aluminum target and the silicon target were activated and operated for 90s and 180s respectively, the power sources of the aluminum target and the silicon target were then shut off; the power supply of the evaporation source was activated to evaporate the AF pill, the AF pill was subjected to evaporation for 180s under the condition that the current of the evaporation source was 720A; then subjected to evaporating for 180s under the condition that the current of the evaporation source was 780A; and subsequently subjected to evaporation for 420s under the condition that the current of the evaporation source was 850A, thereby forming a transparent film layer 2 having a thickness of $0.05 \mu\text{m}$.

[0062] The prepared precious metal article was labeled S1 (its structure was illustrated in FIG. 1) and subjected to performance testing, the results were shown in Table 1.

[0063] Example 2

[0064] The present example served to prepare a pure gold article plated with a transparent film layer using the method of the present disclosure.

[0065] (1) Pre-treatment

[0066] Selection of a precious metal base 1: the pure gold was selected as the material of a precious metal base 1, which had a surface roughness of 0.05 μm ;

[0067] Cleaning: ultrasonically cleaning the pure gold for 5min by using distilled water under the ultrasonic frequency condition of 30kHz, the pure gold after subjecting to ultrasonic cleaning was baked at 150 $^{\circ}\text{C}$ for 30min; then the surface was wiped and cleaned with a dust-free fabric dipped in 98 wt% alcohol;

[0068] Vacuumization of the furnace: the baked pure gold was placed into a vacuum furnace, and the vacuum degree was adjusted to $3 \times 10^{-3}\text{Pa}$, the temperature in the furnace was adjusted to 200 $^{\circ}\text{C}$.

[0069] (2) Deposition of transparent film layer

[0070] The pure gold was placed in a vacuum furnace, and subjected to film plating by means of the vacuum evaporation plating mode according to the same method as that in step (2) of Example 1, except that the power supply of the evaporation source was activated to evaporate the AF pill, the AF pill was subjected to evaporation for 175s under the condition that the current of the evaporation source was 720A; then subjected to evaporating for 175s under the condition that the current of the evaporation source was 760A; and subsequently subjected to evaporation for 410s under the condition that the current of the evaporation source

was 840A, thereby forming a transparent film layer 2 having a thickness of 0.001 μ m.

[0071] The prepared precious metal article was labeled S2 and subjected to performance testing, the results were shown in Table 1.

[0072] Example 3

[0073] The present example served to prepare a pure gold article plated with a transparent film layer using the method of the present disclosure.

[0074] (1) Pre-treatment

[0075] Selection of a precious metal base 1: the pure gold was selected as the material of a precious metal base 1, which had a surface roughness of 0.2 μ m;

[0076] Cleaning: ultrasonically cleaning the pure gold for 10min by using distilled water under the ultrasonic frequency condition of 25kHz, the pure gold after subjecting to ultrasonic cleaning was baked at 150 $^{\circ}$ C for 30min; then the surface was wiped and cleaned with a dust-free fabric dipped in 98 wt% alcohol;

[0077] Vacuumization of the furnace: the baked pure gold was placed into a vacuum furnace, and the vacuum degree was adjusted to 3×10^{-3} Pa in order to ensure the clean vacuum environment in the furnace and the intra-furnace environment was suitable for electroplating.

[0078] (2) Deposition of transparent film layer

[0079] The pure gold was placed in a vacuum furnace, and subjected to

film plating by means of the vacuum evaporation plating mode according to the same method as that in step (2) of Example 1, except that the power supply of the evaporation source was activated to evaporate the AF pill, the AF pill was subjected to evaporation for 170s under the condition that the current of the evaporation source was 720A; then subjected to evaporating for 170s under the condition that the current of the evaporation source was 770A; and subsequently subjected to evaporation for 410s under the condition that the current of the evaporation source was 850A, thereby forming a transparent film layer 2 having a thickness of 0.01 μ m.

[0080] The prepared precious metal article was labeled S3 and subjected to performance testing, the results were shown in Table 1.

[0081] Example 4

[0082] The present example served to prepare a pure gold article plated with a transparent film layer using the method of the present disclosure.

[0083] (1) Pre-treatment

[0084] Selection of a precious metal base 1: the pure gold was selected as the material of a precious metal base 1, which had a surface roughness of 0.03 μ m;

[0085] Cleaning: ultrasonically cleaning the pure gold for 10min by using distilled water under the ultrasonic frequency condition of 25kHz, the pure gold after subjecting to ultrasonic cleaning was baked at 150 $^{\circ}$ C for

30min; then the surface was wiped and cleaned with a dust-free fabric dipped in 98 wt% alcohol;

[0086] Vacuumization of the furnace: the baked pure gold was placed into a vacuum furnace, and the vacuum degree was adjusted to 3×10^{-3} Pa in order to ensure the clean vacuum environment in the furnace and the intra-furnace environment was suitable for electroplating.

[0087] (2) Deposition of transparent film layer

[0088] The pure gold was placed in a vacuum furnace, and subjected to film plating by means of the vacuum evaporation plating mode according to the same method as that in step (2) of Example 1, except that the power supply of the evaporation source was activated to evaporate the AF pill, the AF pill was subjected to evaporation for 170s under the condition that the current of the evaporation source was 700A; then subjected to evaporating for 170s under the condition that the current of the evaporation source was 750A; and subsequently subjected to evaporation for 410s under the condition that the current of the evaporation source was 800A, thereby forming a transparent film layer 2 having a thickness of 0.01 μ m.

[0089] The prepared precious metal article was labeled S4 and subjected to performance testing, the results were shown in Table 1.

[0090] Example 5

[0091] The present example served to prepare a 18k gold precious metal

article plated with a transparent film layer using the method of the present disclosure.

[0092] The transparent film layer was plated on the surface according to the same method applied on the pure gold of Example 1, except that the pure gold was replaced with 18k gold.

[0093] The prepared precious metal article was labeled S5 and subjected to performance testing, the results were shown in Table 1.

[0094] Example 6

[0095] The present example served to prepare a pure gold article plated with a transparent film layer using the method of the present disclosure.

[0096] (1) Pre-treatment

[0097] Selection of a precious metal base 1: the pure gold was selected as the material of a precious metal base 1, which had a surface roughness of 0.02 μm ;

[0098] Cleaning: ultrasonically cleaning the pure gold for 10min by using distilled water under the ultrasonic frequency condition of 25kHz, the pure gold after subjecting to ultrasonic cleaning was baked at 150 $^{\circ}\text{C}$ for 30min; then the surface was wiped and cleaned with a dust-free fabric dipped in 98 wt% alcohol;

[0099] Vacuumization of the furnace: the baked pure gold was placed into a vacuum furnace, and the vacuum degree was adjusted to $3\times 10^{-3}\text{Pa}$ in order to ensure the clean vacuum environment in the furnace and the

intra-furnace environment was suitable for electroplating.

[00100] (2) Deposition of transparent film layer

[00101] The pure gold was placed in a vacuum furnace, and subjected to film plating by means of the vacuum evaporation plating mode according to the same method as that in step (2) of Example 1, except that the power supply of the evaporation source was activated to evaporate the AF pill, the AF pill was subjected to evaporation for 190s under the condition that the current of the evaporation source was 750A; then subjected to evaporating for 190s under the condition that the current of the evaporation source was 800A; and subsequently subjected to evaporation for 430s under the condition that the current of the evaporation source was 900A, thereby forming a transparent film layer 2 having a thickness of 0.01 μ m.

[00102] The prepared precious metal article was labeled S6 and subjected to performance testing, the results were shown in Table 1.

[00103] Example 7

[00104] The present example served to prepare a pure gold article plated with a transparent film layer using the method of the present disclosure.

[00105] The transparent film layer was plated on the surface of pure gold according to the same method as that in Example 1, except that the power supply of the evaporation source was activated to evaporate the AF

pill, the AF pill was subjected to evaporation for 170s under the condition that the current of the evaporation source was 730A; then subjected to evaporating for 180s under the condition that the current of the evaporation source was 770A; and subsequently subjected to evaporation for 420s under the condition that the current of the evaporation source was 820A, thereby forming a transparent film layer 2 having a thickness of 0.0005 μ m.

[00106] The prepared precious metal article was labeled S7 and subjected to performance testing, the results were shown in Table 1.

[00107] Example 8

[00108] The present example served to prepare a pure gold article plated with a transparent film layer using the method of the present disclosure.

[00109] The transparent film layer was plated on the surface of pure gold according to the same method as that in Example 6, except that the power supply of the evaporation source was activated to evaporate the AF pill, the AF pill was subjected to evaporation for 190s under the condition that the current of the evaporation source was 720A; then subjected to evaporating for 190s under the condition that the current of the evaporation source was 780A; and subsequently subjected to evaporation for 420s under the condition that the current of the evaporation source was 860A, thereby forming a transparent film layer 2 having a thickness

of 0.1 μ m.

[00110] The prepared precious metal article was labeled S8 and subjected to performance testing, the results were shown in Table 1.

[00111] Example 9

[00112] The transparent film layer was plated on the surface of pure gold according to the same method as that in Example 1, except that the surface roughness of pure gold was 10 μ m.

[00113] The prepared precious metal article was labeled S9 and subjected to performance testing, the results were shown in Table 1.

[00114] Example 10

[00115] The transparent film layer was plated on the surface of pure gold according to the same method as that in Example 1, except that the surface roughness of pure gold was 1 μ m.

[00116] The prepared precious metal article was labeled S10 and subjected to performance testing, the results were shown in Table 1.

[00117] Example 11

[00118] The transparent film layer was plated on the surface of pure gold according to the same method as that in Example 1, except that the pure gold was subjected to ultrasonically cleaning for 10min under the ultrasonic frequency condition of 5kHz.

[00119] The prepared precious metal article was labeled S11 and subjected to performance testing, the results were shown in Table 1.

[00120] Example 12

[00121] The transparent film layer was plated on the surface of pure gold according to the same method as that in Example 1, except that the pure gold was subjected to ultrasonically cleaning for 10min under the ultrasonic frequency condition of 50kHz.

[00122] The prepared precious metal article was labeled S12 and subjected to performance testing, the results were shown in Table 1.

[00123] Example 13

[00124] The transparent film layer was plated on the surface of pure gold according to the same method as that in Example 1, except that the cleaned pure gold was not subjected to the baking treatment.

[00125] The prepared precious metal article was labeled S13 and subjected to performance testing, the results were shown in Table 1.

[00126] Example 14

[00127] The transparent film layer was plated on the surface of pure gold according to the same method as that in Example 1, except that a transparent film layer having a thickness of 0.15 μ m was formed.

[00128] The prepared precious metal article was labeled S14 and subjected to performance testing, the results were shown in Table 1.

[00129] Example 15

[00130] The transparent film layer was plated on the surface of pure gold according to the same method as that in Example 1, except that a

fluoride transparent film layer 2 having a thickness of 0.002 μ m was formed in step (2).

[00131] The prepared precious metal article was labeled S15 and subjected to performance testing, the results were shown in Table 1.

[00132] Example 16

[00133] The transparent film layer was plated on the surface of pure gold according to the same method as that in Example 1, except that in step (2), the AF pill was subjected to evaporation for 200s under the condition that the current of the evaporation source was 600A; then subjected to evaporating for 200s under the condition that the current of the evaporation source was 700A; and subsequently subjected to evaporation for 300s under the condition that the current of the evaporation source was 750A.

[00134] The prepared precious metal article was labeled S16 and subjected to performance testing, the results were shown in Table 1.

[00135] Comparative example 1

[00136] The transparent film layer was plated on the surface of pure gold according to the same method as that in Example 1, except that in step (2), the pure gold was subjected to a copper plating treatment, the copper-containing electroplating liquid had a pH of 0.1, the plating temperature was 25 $^{\circ}$ C, the cathode current density was 4A/dm², the electroplating was performed for 1 hour, such that a copper layer having a

thickness of 800 μ m was formed on the surface of the pure gold.

[00137] The prepared precious metal article was labeled DS1 and subjected to performance testing, the results were shown in Table 1.

[00138] Comparative example 2

[00139] The transparent film layer was plated on the surface of pure gold according to the same method as that in Example 1, except that an aluminum alloy was used as the precious metal base.

[00140] The prepared precious metal article was labeled DS2 and subjected to performance testing, the results were shown in Table 1.

[00141] Table 1

Numbers	Glossiness (Gu)	Abrasion resistance (N)
S1	873	20
S2	891	20.8
S3	862	18.4
S4	841	20.9
S5	836	24.7
S6	899	24.4
S7	885	23.9
S8	881	20.2
S9	826	20.1
S10	739	19.9
S11	774	19.8

S12	761	19.4
S13	812	19.8
S14	816	17.9
S15	847	19.1
S16	833	18.9
DS1	809	16.8
DS2	782	17.2

[00142] As can be seen from the results of Table 1, by means of the above technical solutions, the surface treatment is carried out in advance on the precious metal base to improve the surface roughness of the precious metal base, the PVD process is then performed such that it is easier to deposit a transparent film layer on the surface of the precious metal base, the formed film layer is more stable, its abrasion resistance is stronger, and the color of the precious metal article is more durable and colorfast.

[00143] Examples 17-32 and Comparative examples 3-4

[00144] The precious metal articles were prepared according to the methods of Examples 1-16 and Comparative Examples 1-2, respectively, except that the silver (containing silver in an amount of 92.5 wt%) was used for replacing the precious metal gold to prepare the precious metal articles S17-S32, DS3 and DS4, respectively, the results of performance test were shown in Table 2.

[00145] Table 2

Numbers	Glossiness (Gu)	Abrasion resistance (N)
S17	868	20
S18	886	20.8
S19	857	18.4
S20	836	20.9
S21	831	24.7
S22	894	24.4
S23	880	23.9
S24	876	20.2
S25	821	20.1
S26	734	19.9
S27	769	19.8
S28	756	19.4
S29	807	19.8
S30	811	17.9
S31	842	19.1
S32	828	18.9
DS3	804	16.8
DS4	777	17.2

[00146] The results of Table 2 demonstrate that the surface treatment is carried out in advance on the precious metal base to improve the surface

roughness of the precious metal base, the PVD process is then performed such that it is easier to deposit a transparent film layer on the surface of the precious metal base, the formed film layer has an improved stability and stronger abrasion resistance, and the color of the precious metal article is more durable and colorfast.

[00147] The above content describes in detail the preferred embodiments of the present disclosure, but the present disclosure is not limited thereto. A variety of simple modifications can be made in regard to the technical solutions of the present disclosure within the scope of the technical concept of the present disclosure, including a combination of individual technical features in any other suitable manner, such simple modifications and combinations thereof shall also be regarded as the content disclosed by the present disclosure, each of them falls into the protection scope of the present disclosure.

Claims

1. A precious metal article comprising a precious metal base (1) and a transparent film layer (2) directly attached on the surface of the precious metal base (1), the precious metal is gold or silver;
wherein the material of the transparent film layer (2) is an AF pill .
2. The precious metal article of claim 1, wherein the gold has a gold content within a range of 33-99.99 wt%, preferably 75-99.99 wt%; and the silver has a silver content within a range of 92.5-99 wt%;
preferably, the precious metal base (1) has a surface roughness of 0.001-50 μ m, more preferably 0.005-0.1 μ m.
3. The precious metal article of claim 1 or 2, wherein the transparent film layer (2) has a thickness of 0.0001-10 μ m, preferably 0.0005-0.1 μ m.
4. A method for preparing a precious metal article of any one of claims 1-3 comprising the following step: depositing the transparent film layer (2) directly on the surface of the precious metal base (1) by physical vapor deposition.
5. The method of claim 4, wherein the method further comprises conducting an intra-furnace vacuumization process prior to depositing a

transparent film layer (2) on the surface of the precious metal base (1), wherein the vacuum degree during the intra-furnace vacuumization process is within a range of $1 \times 10^{-2} \text{Pa}$ - $7 \times 10^{-3} \text{Pa}$.

6. The method of claim 4, wherein the physical vapor deposition mode is vacuum evaporation plating, vacuum sputtering coating or vacuum ion plating;

preferably, the physical vapor deposition mode is the vacuum evaporation plating.

7. The method of claim 6, wherein the vacuum evaporation plating mode comprises: adjusting the vacuum degree to 1.8×10^{-2} - $2.2 \times 10^{-2} \text{Pa}$, enabling the intra-furnace environment to be suitable for electroplating, injecting argon gas with an gas flow of 55-65sccm, adjusting the vacuum degree to 1.3×10^0 - $1.7 \times 10^0 \text{Pa}$, performing glow cleaning for 170-190s, injecting oxygen gas with an oxygen gas flow rate of 75-85sccm, adjusting the vacuum degree to 3.8×10^{-1} - $4.2 \times 10^{-1} \text{Pa}$, activating the aluminum target and the silicon target and operating for 80-100s and 170-190s respectively, and then shutting off the power sources of the aluminum target and the silicon target, activating the power supply of the evaporation source, setting the silicon target current to be within a range of 2.8-3.2A; performing evaporation for 170-190s under the condition that the current

of the evaporation source is within a range of 700-740A; further performing evaporation for 170-190s under the condition that the current of the evaporation source is within a range of 750-800A; subsequently performing evaporation for 410-430s under the condition that the current of the evaporation source is within a range of 800-900A; thereby forming a transparent film layer having a thickness within a range of 0.0001-10 μ m.

8. The method of any one of claims 4-7, wherein the method further comprises cleaning the surface of the precious metal base (1), the cleaning mode is ultrasonically cleaning the surface of the precious metal base (1) for 1-15min under the ultrasonic frequency condition of 20-30kHz, and/or, wiping and cleaning the surface of the precious metal base (1) with a dust-free cloth dipped in 95-98 wt% alcohol.

9. The method of claim 8, wherein the method further comprises a step of baking the ultrasonically treated precious metal base (1), the baking temperature is 100-150°C, and the baking time is 5-30min.