

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

FIELD

[0001] The present disclosure relates to the technical field of plating layer on the precious metal surface, particularly relates to a precious metal article having 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 wide spread 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.

[0004] 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.

[0005] 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; subsequently 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.

[0006] 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.

[0007] The above 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

[0008] The present disclosure aims to solve the problems in the prior art in regard to unstable plating layer on the precious metal surface, or low brightness of the plating layer, or the plating layer is too thin, and provides a precious metal article having a plating layer on the surface and a preparation method thereof, the surface of the precious metal article in the present disclosure is formed with different kinds of film layers, the formed film layers have a stable structure, or high brightness, or a large thickness of the plating layer, and may exhibit diverse colors.

[0009] In order to fulfill the above purposes, a first aspect of the present disclosure provides a precious metal article, wherein the precious metal article comprises a precious metal base, and a first layer and a second layer sequentially attached on the precious metal base; wherein the first layer is any one of a physical vapor deposition layer, a galvanic plating layer and an electrophoretic layer, the second layer is a transparent film layer, and the precious metal is gold or silver.

[0010] In a second aspect, the present disclosure provides a method of preparing the aforementioned precious metal article, wherein the method comprises the following steps:

[0011] (1) forming a first layer on the surface of a precious metal base;

[0012] (2) depositing a second layer on the first layer by using physical vapor deposition;

[0013] wherein the physical vapor deposition layer is deposited on the surface of the precious metal base by means of physical vapor deposition; or the galvanic plating layer is formed on the surface of the precious metal base by means of a galvanic plating process; or the electrophoretic layer is formed on the surface of the precious metal base by means of an electrophoretic process.

[0014] Due to the aforementioned technical solution, a physical vapor deposition layer is formed on a surface of a precious metal base by means of physical vapor deposition (PVD), the PVD layer can form a film layer with luxuriant colors, improve a single gold/silver color of the precious metal base, and the color change does not influence purity of the precious metal base; or a galvanic plating layer is formed on the precious metal base by adopting the galvanic plating process, the galvanic plating layer may form a film layer with luxuriant colors, improve a single gold/silver color of the precious metal base, enhance brightness of the film layer; or an electrophoretic layer is formed on the precious metal base by means of

an electrophoresis process, the electrophoretic layer may form a film layer with luxuriant colors, and improve a single gold/silver color of the precious metal base; and a transparent film layer is further deposited on the physical vapor deposition layer, or the galvanic plating layer or the electrophoretic layer, such that the formed film layer to be more stable, and further reinforce the abrasion resistance, and the formed color is more durable with colorfastness. According to a preferred embodiment of the present disclosure, the precious metal base is subjected to a surface pretreatment so as to improve a surface roughness of the precious metal base, and a first layer is subsequently formed on a surface of the precious metal base, the first layer can cause that the formed film layer has an improved stability and wear resistance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 illustrates a schematic view of the structure of the precious metal article of Example 1.

[0016] Description of the reference signs

[0017] 1. Precious metal base

[0018] 2. First layer (a physical vapor deposition layer or a galvanic plating layer or an electrophoretic layer)

[0019] 3. Second layer (transparent film layer)

DETAILED DESCRIPTION

[0020] 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.

[0021] A first aspect of 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 first layer 2 and a second layer 3 sequentially attached on the precious metal base (1); wherein the first layer 2 is any one of a physical vapor deposition layer, a galvanic plating layer and an electrophoretic layer, the second layer 3 is a transparent film layer, and the precious metal is gold or silver.

[0022] The precious metal base 1 according to the present disclosure may have a precious metal content within a range 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.

[0023] According to the present disclosure, it is preferable that the silver has a silver content within a range of 92.5-99 wt%.

[0024] According to the present disclosure, the surface roughness of the precious metal base 1 is preferably 0.001-50 μ m, more preferably 0.005-0.1 μ m; 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.

[0025] 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.

[0026] 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 will be influenced.

[0027] According to the present disclosure, the physical vapor deposition layer may have a gold content of 0.1 wt% or less or 33 wt% or more, it is preferable that the physical vapor deposition layer has a gold content of 0.01 wt% or less or between 70-90 wt%; more preferably, the physical vapor deposition layer has a gold content within the ranges of 0.001-0.008 wt% or 75-85 wt%.

[0028] According to the present disclosure, the thickness of the physical vapor deposition layer may be within a range of 10nm-50 μ m (such as 10nm, 20nm, 30nm, 50nm, 80nm, 100nm, 250nm, 500nm, 800nm, 1 μ m, 10 μ m, 30 μ m, 50 μ m or any value therebetween), preferably 0.04-0.3 μ m; when the thickness falls into the thickness range of the present disclosure, the bonding between the physical vapor deposition layer and the precious metal base 1 is stronger, and the physical vapor deposition layer does not affect purity of the precious metal base 1 per se when the precious metal article is detected.

[0029] According to the present disclosure, the physical vapor deposition layer may have a single pure color or a mottled color; for example, PVD can be used to deposit the same single pure color on the surface of the precious metal base 1 as a whole. Specifically, the material of the physical vapor deposition layer may be a conventional metal oxide, metal

nitride, metal carbide, metal fluoride, metal sulfide, metal boride, diamond-like carbon (DLC) film with a color, such as one or more selected from the group consisting of Ni, Ti, Zn, Cr, Mg, Nb, Sn, Al, In, Fe, Zr, Si, Cu, Ta, Ge, Ag, Co, Au, Gd, La, Y, Ce, W, Hf, Mo, CrN, TiN, TiAlCN, TiCN, TiAlN, AlTiN, TiB₂, ZrN, FeCo, AlSi, TiSi, CrSi, ZnAl, TiZn, TiAl, TiZr, TiSi, TiNi, NiAl, NiV, NiFe, gold-copper alloy and DLC, preferably gold-copper alloy; wherein the DLC is a carbon film having a noncrystalline structure.

[0030] In addition, PVD can be used in the present disclosure to deposit a variegated color on the surface of the precious metal base 1, and in particular, the surface portion of the precious metal base 1 can be processed with another color by masking, for example, a portion of the color deposited on the surface of the precious metal base 1 can be removed through the computer numerical control (CNC) machine tool or the manual grinding and polishing method, such that the surface of the precious metal base 1 can present diverse colors.

[0031] According to the present disclosure, the surface of the physical vapor deposition layer may be a plane or a concave surface or a convex surface to present various patterns.

[0032] According to the present disclosure, the thickness of the galvanic plating layer may be within a range of 0.05-50 μ m, preferably 0.1-1.5 μ m, and more preferably 0.5-1.5 μ m; and in the present disclosure, the

glossiness of the film layer can be increased by limiting the thickness of the galvanic plating layer in the above range. The material of the galvanic plating layer may be a gold-copper alloy, wherein the weight ratio of the amount of gold and the amount of copper in the gold-copper alloy may be (75-85): (15-25), preferably 85:15 or 75:25.

[0033] According to the present disclosure, the thickness of the transparent film layer may be within a range of 0.0001-10 μ m, preferably 0.0005-0.1 μ m. It is preferable in the present disclosure that the transparent film layer is made of 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.

[0034] The present disclosure defines the thickness and material of the transparent film layer 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.

[0035] According to the present disclosure, the thickness of the

electrophoretic layer may be within a range of 0.1-20 μ m, preferably 1-15 μ m, more preferably 5-10 μ m.

[0036] 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.

[0037] In a second aspect, the present disclosure provides a method for preparing the aforementioned precious metal article, wherein the method comprises the following steps:

[0038] (1) forming a first layer 2 on the surface of the precious metal base 1;

[0039] (2) depositing a second layer 3 on the first layer 2 by using physical vapor deposition;

[0040] wherein the physical vapor deposition layer is deposited on the surface of the precious metal base 1 by means of physical vapor deposition; the galvanic plating layer is formed on the surface of the precious metal base 1 by means of a galvanic plating process; the electrophoretic layer is formed on the surface of the precious metal base 1 by means of an electrophoretic process.

[0041] According to the present disclosure, in step (1), a physical vapor deposition layer is deposited on the surface of the precious metal base 1 by means of physical vapor deposition, wherein the physical vapor

deposition mode is vacuum evaporation plating, vacuum sputtering coating or vacuum ion plating.

[0042] Preferably, the physical vapor deposition mode is vacuum ion plating.

[0043] More preferably, the vacuum ion plating comprises the following steps: heating the precious metal base 1 under the vacuum conditions, activating a metal target, and injecting a gas, applying a bias voltage, and plating film on the surface of the precious metal base 1.

[0044] Wherein, in case of that the vacuum conditions comprises a vacuum degree of $1 \times 10^{-2} \text{Pa}$ - $9.5 \times 10^{-1} \text{Pa}$, and the heating temperature is within a range of 50-260 °C, the temperature will influence the bonding force between the plating layer and the precious metal base 1 and a color of the plating layer, especially in the case of producing a rose gold color, the heating temperature in the furnace is generally within a range of 100-250 °C, preferably 200 °C.

[0045] 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.

[0046] wherein the metal target uses a metal which 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 a gold-copper alloy.

[0047] 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.

[0048] 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.

[0049] 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.

[0050] 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.

[0051] According to the present disclosure, the metal target and the protective 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.

[0052] According to the present disclosure, in step (1), the method further comprises conducting an intra-furnace vacuumization process prior to depositing a physical vapor deposition layer on the surface of the precious metal base 1, wherein the vacuum degree during the intra-furnace vacuumization process is within a range of 1×10^{-2} Pa- 7×10^{-3} 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.

[0053] According to the present disclosure, in step (1), the galvanic plating layer is formed on the surface of the precious metal base 1 by using a galvanic plating process, wherein the galvanic plating solution in the galvanic plating process is not specifically limited and may be a conventional choice in the art, for example, a gold-copper alloy may be selected, wherein the weight ratio of the amount of gold and the amount of copper in the gold-copper alloy may be (75-85): (15-25), preferably 85:15 or 75:25; a galvanic plating current is within a range of 0.5-0.9A, preferably 0.7-0.8A; the temperature is within a range of 50-80 °C, preferably 65-75 °C; and the galvanic plating time is within a range of 1-5 min, preferably 2-3 min. In the present disclosure, the galvanic plating conditions are defined in the above range, the thickness of the galvanic plating layer as defined in the present disclosure can be formed.

[0054] In particular, the process of galvanic plating involves: initially hanging up, then cleaning the article surface and performing the galvanic plating.

[0055] According to the present disclosure, in step (1), an electrophoretic layer is formed on the surface of the precious metal base 1 using an electrophoresis process, wherein the electrophoresis conditions include that a direct current voltage is within a range of 100-200V, an

electrophoretic coating is performed for 3-10min, and a baking process is performed under a temperature of 120-250 °C for 10-30min. In the present disclosure, the material for performing electrophoresis is not specifically limited, and for example, it may be a paint, and in particular, the components of the paint may be one or more selected from the group consisting of a water-soluble resin, a pigment, a filler, an adjuvant, a solvent and a neutralizing agent.

[0056] In particular, the electrophoresis process comprises the following steps: initially hanging up, performing surface treatment (surface cleaning and degreasing), then subjecting the paint to an electrophoresis process (for 1-2 minutes), washing and cleaning (rinsing redundant and residual electrophoretic paint on the surface), and baking.

[0057] According to the present disclosure, in step (2), the physical vapor deposition mode is vacuum evaporation plating, vacuum sputtering coating or vacuum ion plating.

[0058] Preferably, the physical vapor deposition mode is vacuum evaporation plating.

[0059] Preferably, the vacuum evaporation plating mode comprises the following steps: activating current of the evaporation source, evaporating the fluoride to form a transparent film layer.

[0060] Preferably, the vacuum evaporation plating mode comprises: evaporating for 170-190s under the condition that the current of an

evaporation source is within a range of 700-750A; then evaporating for 170-190s under the condition that the current of an evaporation source is within a range of 750-800A; subsequently evaporating for 410-430s under the condition that the current of an evaporation source is within a range of 800-900A. More specifically, the vacuum evaporation plating mode comprises the following steps: adjusting the vacuum degree to be within a range of 1.8×10^{-2} - 2.2×10^{-2} Pa such that the intra-furnace environment is suitable for electroplating; injecting argon gas with an argon gas flow rate of 55-65sccm, adjusting the vacuum degree to be within a range of 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 be within a range of 3.8×10^{-1} - 4.2×10^{-1} Pa; activating an aluminum target and a silicon target and operating for 80-100s and 170-190s, respectively; then shutting off the power sources of the aluminum target and the silicon target; activating a power supply of an evaporation source such that the current of a silicon target is within a range of 2.8-3.2A; evaporating for 170-190s under the condition that the current of an evaporation source is within a range of 700-740A; then evaporating for 170-190s under the condition that the current of an evaporation source is within a range of 750-800A; subsequently evaporating for 410-430s under the condition that the current of an evaporation source is within a range of 800-900A; thereby

forming a transparent film having a thickness of 0.0001-10 μ m, particularly 0.1-10nm.

[0061] In addition, the vacuum evaporation plating is performed under the conditions consisting of a normal temperature, a vacuum level of 3 $\times 10^{-7}$ Pa-6 $\times 10^{-7}$ Pa, an argon gas flow rate 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 targets are an aluminum target, a silicon target; the current is within a range of 2-3A when the aluminum target is selected, and the current is within a range of 2-3A when the silicon target is selected.

[0062] According to the present disclosure, a glow cleaning is performed in step (1) and/or step (2) prior to the physical vapor deposition, wherein the conditions of glow cleaning comprises an argon gas flow rate within a range of 100-320sccm, preferably 280-320sccm; an applied bias voltage of 380-1,000V, preferably 380-420V, a duty ratio of 10-80%, preferably 48-52%, and a time of 160-720s, preferably 160-200s.

[0063] According to the present disclosure, the method further comprises cleaning the surface of the precious metal base 1 prior to step (1).

[0064] 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.

[0065] 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.

[0066] 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, the surface of the precious metal base 1 may be directly wiped with 95-98 wt% of alcohol.

[0067] 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.

[0068] 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 physical vapor deposition layer 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.

[0069] According to the present disclosure, the method may 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.

[0070] 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.

[0071] The present disclosure will be described in detail below with reference to examples.

[0072] In the following Examples and Comparative examples:

[0073] Glossiness: the glossiness of the precious metal articles was measured with a LS192 glossiness instrument at an angle of 60 °.

[0074] Abrasion resistance: the WS-97 coating adhesive force scratch tester developed by the ZhongkeKaihua 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.

[0075] Example 1

[0076] The example aimed to prepare a pure gold article with a coffee TiAlN-plated film with the method of the present disclosure.

[0077] (1) Pre-processing

[0078] 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;

[0079] Cleaning: ultrasonically cleaning the pure gold for 10min by using distilled water under the ultrasonic frequency condition of 20kHz, the pure gold subjected 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;

[0080] 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 cause that the intra-furnace environment is suitable for electroplating;

[0081] (2) Physical vapor deposition layer

[0082] Glow cleaning: the glow cleaning was performed under the conditions consisting of an argon gas flow rate of 300sccm, an applied bias voltage of 400V, a duty ratio of 50% and a time of 400s;

[0083] The temperature in the furnace was then adjusted to 200 °C, the TiAl column target was activated, wherein the Ti/Al atomic ratio was 7: 3, the current of the target material was 25A; the protective gas argon gas was injected with a gas flow of 130sccm, and the nitrogen gas was injected with a gas flow of 150sccm, the vacuum degree was adjusted to 3.0×10^{-1} Pa, the applied bias voltage was 100V and the duty ratio was 50%, the depositing process was performed for 30min, thereby forming a coffee TiAlN film with a thickness of 0.3 μ m on the surface of the pure gold;

[0084] (3) Transparent film layer

[0085] The pure gold having a surface plated with a physical vapor deposition layer 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 1.5×10^0 Pa, the glow cleaning was performed for 180s; the oxygen gas was injected with a gas flow of 80sccm, the vacuum degree was adjusted to 4.0×10^{-1} 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; the

current of the silicon target was 3A; the evaporation was performed for 180s under the condition that the current of the evaporation source was 720A; the evaporation was further performed for 180s under the condition that the current of the evaporation source was 780A; the evaporation was subsequently performed for 420s under the condition that the current of the evaporation source was 850A; thereby forming a transparent film layer having a thickness of 0.05 μ m.

[0086] The prepared precious metal article was marked as S1 (its structure was shown in FIG. 1) and subjected to performance testing, the results were shown in Table 1.

[0087] Example 2

[0088] The example aimed to prepare a pure gold article with a gray-black CrN-plated film with the method of the present disclosure.

[0089] (1) Pre-processing

[0090] 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 μ m;

[0091] Cleaning: ultrasonically cleaning the pure gold for 5min by using distilled water under the ultrasonic frequency condition of 30kHz, the pure gold subjected 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;

[0092] 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, and the temperature in the furnace was adjusted to 200 °C;

[0093] (2) Physical vapor deposition layer

[0094] Glow cleaning: the glow cleaning was performed under the conditions consisting of an argon gas flow rate of 300sccm, an applied bias voltage of 400V, a duty ratio of 50% and a time of 400s;

[0095] A high-purity medium-frequency chromium arc target was activated, wherein the current of the target material was 100A; the nitrogen gas was injected with a gas flow of 230sccm, the vacuum degree was adjusted to 3.0×10^{-1} Pa, the applied bias voltage was 100V and the duty ratio was 50%, the depositing process was performed for 5min, thereby forming a gray black CrN film with a thickness of 0.15μm on the surface of the pure gold.

[0096] (3) Transparent film layer

[0097] The pure gold having a surface plated with a physical vapor deposition layer was placed in a vacuum furnace, and subjected to film plating by means of a vacuum evaporation plating mode, thereby forming a transparent film layer having a thickness of 0.001μm.

[0098] The prepared precious metal article was marked as S2 and subjected to performance testing, the results were shown in Table 1.

[0099] Example 3

[00100] The example aimed to prepare a pure gold article with a black DLC-plated film with the method of the present disclosure.

[00101] (1) Pre-processing

[00102] 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;

[00103] Cleaning: ultrasonically cleaning the pure gold for 10min by using distilled water under the ultrasonic frequency condition of 25kHz, the pure gold subjected 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;

[00104] 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 cause that the intra-furnace environment is suitable for electroplating;

[00105] (2) physical vapor deposition layer

[00106] Glow cleaning: the glow cleaning was performed under the conditions consisting of an argon gas flow rate of 300sccm, an applied bias voltage of 400V, a duty ratio of 50% and a time of 400s;

[00107] The temperature in the furnace was then adjusted to 200 $^{\circ}$ C, the chromium target column target was activated, the current of the target material was 20A; the protective gas argon gas was injected with a gas

flow of 130sccm, the acetylene gas was injected with a gas flow of 200sccm, the applied bias voltage was 50V and the duty ratio was 50%, the depositing process was performed for 50min, thereby forming a black film layer with a thickness of 0.5 μ m on the surface of the pure gold. Then the power supply of the chromium target column target was shut off, the acetylene gas was injected with a gas flow of 200sccm, the applied bias voltage was 1,000V, the duty ratio was 80%, the depositing process was performed for 5h, such that a DLC film with the thickness of 0.1 μ m was formed on the surface of the pure gold.

[00108] (3) Transparent film layer

[00109] The pure gold having a surface plated with a physical vapor deposition layer was placed in a vacuum furnace, and subjected to film plating by means of a vacuum evaporation plating mode, thereby forming a transparent film layer having a thickness of 0.01 μ m.

[00110] The prepared precious metal article was marked as S3 and subjected to performance testing, the results were shown in Table 1.

[00111] Example 4

[00112] The example aimed to prepare a pure gold article with a golden yellow color TiN-plated film with the method of the present disclosure.

[00113] (1) Pre-processing

[00114] 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 $0.03\mu\text{m}$;

[00115] Cleaning: ultrasonically cleaning the pure gold for 10min by using distilled water under the ultrasonic frequency condition of 25kHz, the pure gold subjected to ultrasonic cleaning was baked at $150\text{ }^{\circ}\text{C}$ for 30min; then the surface was wiped and cleaned with a dust-free fabric dipped in 98 wt% alcohol;

[00116] 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 cause that the intra-furnace environment is suitable for electroplating;

[00117] (2) Physical vapor deposition layer

[00118] Glow cleaning: the glow cleaning was performed under the conditions consisting of an argon gas flow rate of 300sccm, an applied bias voltage of 400V, a duty ratio of 50% and a time of 400s;

[00119] The Ti column target was activated, the current of the target material was 20A. The protective gas argon gas was injected with a gas flow of 130sccm, and the nitrogen gas was injected with a gas flow of 200sccm, the vacuum degree was adjusted to $5\times 10^{-1}\text{Pa}$. The applied bias voltage was 100V, the duty ratio was 50%, the depositing process was performed for 30min, thereby forming a golden yellow TiN film with a thickness of $0.2\mu\text{m}$ on the surface of the pure gold.

[00120] (3) Transparent film layer

[00121] The pure gold having a surface plated with a physical vapor deposition layer was placed in a vacuum furnace, and subjected to film plating by means of a vacuum evaporation plating mode, thereby forming a transparent film layer having a thickness of 0.01 μ m.

[00122] The prepared precious metal article was marked as S4 and subjected to performance testing, the results were shown in Table 1.

[00123] Example 5

[00124] The example aimed to prepare a 18K gold precious metal article with a coffee TiAlN-plated film prepared with the method of the present disclosure.

[00125] The plating layer was performed on a surface of the pure gold according to the same method as that in Example 1, except that the pure gold was replaced by the 18K gold.

[00126] The prepared precious metal article was marked as S5 and subjected to performance testing, the results were shown in Table 1.

[00127] Example 6

[00128] The example aimed to prepare a pure gold precious metal article with a rose gold and partial reddish color using the method of the present disclosure.

[00129] (1) Pre-processing

[00130] 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 $0.02\mu\text{m}$;

[00131] Cleaning: ultrasonically cleaning the pure gold for 10min by using distilled water under the ultrasonic frequency condition of 25kHz, the pure gold subjected to ultrasonic cleaning was baked at $150\text{ }^{\circ}\text{C}$ for 30min; then the surface was wiped and cleaned with a dust-free fabric dipped in 98 wt% alcohol;

[00132] 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 cause that the intra-furnace environment is suitable for electroplating;

[00133] (2) Physical vapor deposition layer

[00134] Glow cleaning: the glow cleaning was performed under the conditions consisting of an argon gas flow rate of 300sccm, an applied bias voltage of 400V, a duty ratio of 50% and a time of 400s;

[00135] The temperature in the furnace was subsequently adjusted to $200\text{ }^{\circ}\text{C}$, the gold-copper target column target was activated, wherein the Au/Cu atomic ratio was 75: 25, the current of the target material was 3A. The protective gas argon gas was injected with a gas flow of 130sccm, the vacuum degree was adjusted to $3\times 10^{-1}\text{Pa}$. The applied bias voltage was 100V and the duty ratio was 50%, the depositing process was performed for 20min, thereby forming a rose gold and partial reddish

color film layer with a thickness of 0.1 μ m on the surface of the pure gold.

[00136] (3) Transparent film layer

[00137] The pure gold having a surface plated with a physical vapor deposition layer was placed in a vacuum furnace, and subjected to film plating by means of a vacuum evaporation plating mode, thereby forming a transparent film layer having a thickness of 0.01 μ m.

[00138] The prepared precious metal article was marked as S6 and subjected to performance testing, the results were shown in Table 1.

[00139] Example 7

[00140] The example aimed to prepare a pure gold precious metal article with rose gold and partial purple color using the method of the present disclosure.

[00141] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 6, except that in step (2), the TiAl column target was activated, wherein the Ti/Al atomic ratio was 7: 3, the current of the target material was 20A; the protective gas argon gas was injected with a gas flow of 130sccm, and the nitrogen gas was injected with a gas flow of 200sccm, the vacuum degree was adjusted to 5.0 $\times 10^{-1}$ Pa, the applied bias voltage was 100V and the duty ratio was 50%, the depositing process was performed for 30min, thereby forming a rose gold and partial purple color film layer with a thickness of 0.3 μ m on the surface of the pure gold.

[00142] The prepared precious metal article was marked as S7 and subjected to performance testing, the results were shown in Table 1.

[00143] Example 8

[00144] The example aimed to prepare a pure gold precious metal article with a rose gold and partial yellowish color using the method of the present disclosure.

[00145] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 6, except that in step (2), the TiAl column target was activated, wherein the Ti/Al atomic ratio was 8: 2, the current of the target material was 20A; the protective gas argon gas was injected with a gas flow of 130sccm; the vacuum degree was adjusted to 5.0×10^{-1} Pa; the nitrogen gas was injected with a gas flow of 100sccm; the applied bias voltage was 100V and the duty ratio was 50%, the depositing process was performed for 30min, thereby forming a rose gold and partial yellowish color film layer with a thickness of 0.3 μ m on the surface of the pure gold.

[00146] The prepared precious metal article was marked as S8 and subjected to performance testing, the results were shown in Table 1.

[00147] Example 9

[00148] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 1, except that in step (2), a physical vapor deposition layer was not formed, but a galvanic

plating layer was formed, wherein the conditions of forming the galvanic plating layer comprised initially hanging up, cleaning the surface of the article after subjecting to step (1), then gold-copper alloy was used as the material of the galvanic plating layer, the weight ratio of the amount of gold and the amount of copper in the gold-copper alloy was 75:25; the current of the galvanic plating was 0.8A, the temperature was 70 ℃, and the galvanic plating time was 2min.

[00149] The prepared precious metal article was marked as S9 and subjected to performance testing, the results were shown in Table 1.

[00150] Example 10

[00151] The example aimed to prepare a pure gold precious metal article with a purple color using the method of the present disclosure.

[00152] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 6, except that in step (2), the temperature in the furnace was adjusted to 200 ℃, the Ti target arc target was activated, the current of the target material was 100A; the protective gas argon gas was injected with a gas flow of 130sccm, the vacuum degree was adjusted to 2.0×10^{-1} Pa; the oxygen gas was injected with a gas flow of 100sccm; the applied bias voltage was 100V, the duty ratio was 50%, the depositing process was performed for 3min, thereby forming a film with a thickness of 0.1μm on the surface of the pure gold.

[00153] The prepared precious metal article was marked as S10 and

subjected to performance testing, the results were shown in Table 1.

[00154] Example 11

[00155] The example aimed to prepare a pure gold precious metal article with a violaceous color using the method of the present disclosure.

[00156] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 6, except that in step (2), the temperature in the furnace was adjusted to 260 °C, the TiAl target arc target was activated, the atomic ratio of Ti/Al was 7:3, the current of the target material was 90A; the nitrogen gas was injected with a gas flow of 240sccm, the vacuum degree was adjusted to 6.0×10^{-1} Pa; the applied bias voltage was 120V and the duty ratio was 40%, the depositing process was performed for 20min, thereby forming a film with a thickness of 0.3μm on the surface of the pure gold.

[00157] The prepared precious metal article was marked as S11 and subjected to performance testing, the results were shown in Table 1.

[00158] Example 12

[00159] The example aimed to prepare a pure gold precious metal article with a champagne gold color using the method of the present disclosure.

[00160] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 6, except that in step (2), the temperature in the furnace was adjusted to 200 °C, the Ti

target arc target was activated, the current of the target material was 80A; the protective gas argon gas was injected with a gas flow of 130sccm, the vacuum degree was adjusted to 3.0×10^{-1} Pa; the nitrogen gas was injected with a gas flow of 100sccm; the applied bias voltage was 80V, the duty ratio was 60%, the depositing process was performed for 5min, thereby forming a film with a thickness of 0.1 μ m on the surface of the pure gold.

[00161] The prepared precious metal article was marked as S12 and subjected to performance testing, the results were shown in Table 1.

[00162] Example 13

[00163] The example aimed to prepare a pure gold precious metal article with a magic color using the method of the present disclosure.

[00164] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 6, except that in step (2), the temperature in the furnace was adjusted to 150 °C, the Ti target arc target was activated, the current of the target material was 100A; the protective gas argon gas was injected with a gas flow of 130sccm, the vacuum degree was adjusted to 3.0×10^{-1} Pa; the oxygen gas was injected with a gas flow of 100sccm; the applied bias voltage was 100V, the duty ratio was 50%, the depositing process was performed for 10min, thereby forming a film with a thickness of 0.2 μ m on the surface of the pure gold.

[00165] The prepared precious metal article was marked as S13 and subjected to performance testing, the results were shown in Table 1.

[00166] Example 14

[00167] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 1, except that the surface roughness of pure gold was 0.008 μm .

[00168] The prepared precious metal article was marked as S14 and subjected to performance testing, the results were shown in Table 1.

[00169] Example 15

[00170] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 1, except that the surface roughness of pure gold was 1 μm .

[00171] The prepared precious metal article was marked as S15 and subjected to performance testing, the results were shown in Table 1.

[00172] Example 16

[00173] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 1, except that the pure gold was ultrasonically cleaned for 10min with the ultrasonic frequency of 5kHz.

[00174] The prepared precious metal article was marked as S16 and subjected to performance testing, the results were shown in Table 1.

[00175] Example 17

[00176] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 1, except that the

pure gold was ultrasonically cleaned for 10min with the ultrasonic frequency of 50kHz.

[00177] The prepared precious metal article was marked as S17 and subjected to performance testing, the results were shown in Table 1.

[00178] Example 18

[00179] The plating layer was performed on the surface of the 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.

[00180] The prepared precious metal article was marked as S18 and subjected to performance testing, the results were shown in Table 1.

[00181] Example 19

[00182] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 9, except that the formed deposition layer had a thickness of 5nm, the galvanic plating layer had a thickness of 0.01 μ m, and the transparent film layer had a thickness of 0.15 μ m.

[00183] The prepared precious metal article was marked as S19 and subjected to performance testing, the results were shown in Table 1.

[00184] Example 20

[00185] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 1, except that a fluoride transparent film layer having a thickness of 0.001 μ m was formed

in step (3).

[00186] The prepared precious metal article was marked as S20 and subjected to performance testing, the results were shown in Table 1.

[00187] Example 21

[00188] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 1, except that in step (2), the Ti/Al atomic ratio was 6: 4, the current of the target material was 10A; the protective gas argon gas was injected with a gas flow of 600sccm; the nitrogen gas was injected with a gas flow of 600sccm; the vacuum degree was adjusted to 3.5×10^{-1} Pa; the applied bias voltage was 200V and the duty ratio was 90%.

[00189] The prepared precious metal article was marked as S21 and subjected to performance testing, the results were shown in Table 1.

[00190] Example 22

[00191] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 9, except that the conditions of forming the galvanic plating layer comprised a galvanic plating current of 1.0A, a temperature of 90 °C, and a galvanic plating time of 6min.

[00192] The prepared precious metal article was marked as S22 and subjected to performance testing, the results were shown in Table 1.

[00193] Example 23

[00194] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 1, except that in step (3), the evaporating process was performed for 200s under the condition that the current of the evaporation source was 600A; the evaporating process was further performed for 200s under the condition that the current of the evaporation source was 700A; the evaporating process was subsequently performed for 300s under the condition that the current of the evaporation source was 750A.

[00195] The prepared precious metal article was marked as S23 and subjected to performance testing, the results were shown in Table 1.

[00196] Example 24

[00197] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 1, except that in step (2), a physical vapor deposition layer was not formed, but an electrophoretic layer was formed, wherein the conditions for forming the electrophoretic layer included a DC voltage of 150V and an electrophoretic coating time of 5min.

[00198] The prepared precious metal article was marked as S24 and subjected to performance testing, the results were shown in Table 1.

[00199] Example 25

[00200] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 1, except that in

step (2), a physical vapor deposition layer was not formed, but a galvanic plating layer was formed, wherein the conditions for forming the galvanic plating layer included an use of the galvanic plating process with a galvanic plating current of 0.8A, a temperature of 70 °C and the galvanic plating time of 2min, thereby forming a galvanic plating layer with a thickness of 1.0 μ m.

[00201] The prepared precious metal article was marked as S25 and subjected to performance testing, the results were shown in Table 1.

[00202] Comparative example 1

[00203] The plating layer was performed on the surface of the 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 under the conditions consisting of a copper-containing plating solution having a pH of 0.1, a plating temperature of 25 °C, a cathode current density of 4A/dm², and a plating time of 1h, thereby forming a copper layer having a thickness of 800 μ m on the surface of the pure gold.

[00204] The prepared precious metal article was marked as DS1 and subjected to performance testing, the results were shown in Table 1.

[00205] Comparative example 2

[00206] The plating layer was performed on the surface of the pure gold according to the same method as that in Example 1, except that an aluminum alloy was used as the substrate. The prepared precious metal

article was marked as DS2 and subjected to performance testing, the results were shown in Table 1.

[00207] Table 1

Numbers	Glossiness/GU	Abrasion resistance/N
S1	897	21
S2	915	21.8
S3	886	19.4
S4	865	21.9
S5	860	25.7
S6	923	25.4
S7	909	24.9
S8	905	21.2
S9	870	23.8
S10	875	24.3
S11	872	26.4
S12	880	23.7
S13	885	23.6
S14	850	21.1
S15	763	20.9
S16	798	20.8
S17	785	20.4
S18	836	20.8
S19	840	18.9
S20	861	20.1
S21	850	19.5
S22	845	19.6
S23	857	19.9
S24	865	19.2
S25	900	19.3

DS1	833	17.8
DS2	806	18.2

[00208] As can be seen from the results of Table 1, the film layer formed on the surface of the precious metal produced with the aforementioned methods has a small thickness, and can exhibit diverse colors. By performing the above technical solutions, the precious metal base was subjected to surface pre-treatment to improve the surface roughness of the precious metal base, then a plating film is performed on the surface of the precious metal base by means of PVD to form a physical vapor deposition layer, so as to form a film layer with luxuriant colors, improve a single gold color of the precious metal base, and the color change does not influence purity of the precious metal base; or a galvanic plating layer is formed on the precious metal base by adopting the galvanic plating process, the galvanic plating layer may enhance brightness of the film layer; or an electrophoretic layer is formed on the precious metal base by means of an electrophoresis process, the electrophoretic layer may increase thickness of the precious metal article; and a transparent film layer is further deposited on the physical vapor deposition layer, or the galvanic plating layer, or the electrophoretic layer by means of PVD, such that the formed film layer has enhanced stability and abrasion resistance, and the formed color is more durable with colorfastness.

[00209] Examples 26-50 and Comparative examples 3-4

[00210] The precious metal articles were prepared according to same methods of Examples 1-25 and Comparative examples 1-2, respectively, except that the silver (having a silver content of 92.5 wt%) was respectively used for replacing the precious metal gold, and the results of the performance testing are shown in Table 2.

[00211] Table 2

Numbers	Glossiness/GU	Abrasion resistance/N
S26	893	21
S27	915	21.8
S28	886	19.4
S29	865	21.9
S30	860	25.7
S31	923	25.4
S32	909	24.9
S33	905	21.2
S34	870	23.8
S35	875	24.3
S36	872	26.4
S37	880	23.7
S38	885	23.6
S39	850	21.1
S40	763	20.9
S41	798	20.8
S42	785	20.4
S43	836	20.8
S44	840	18.9
S45	861	20.1
S46	850	19.5

S47	845	19.6
S48	857	19.9
S49	865	19.2
S50	900	19.3
DS3	833	17.8
DS4	806	18.2

[00212] The results of Table 2 demonstrate that the film layer formed on the surface of the precious metal produced with the aforementioned methods has a small thickness, and can exhibit diverse colors. By performing the above technical solutions, the precious metal base was subjected to surface pre-treatment to improve the surface roughness of the precious metal base, then a plating film is performed on the surface of the precious metal base by means of PVD to form a physical vapor deposition layer, so as to form a film layer with luxuriant colors, improve a single silver color of the precious metal base, and the color change does not influence purity of the precious metal base; or a galvanic plating layer is formed on the precious metal base by adopting the galvanic plating process, the galvanic plating layer may enhance brightness of the film layer; or an electrophoretic layer is formed on the precious metal base by means of an electrophoresis process, the electrophoretic layer may increase thickness of the precious metal article; and a transparent film layer is further deposited on the physical vapor deposition layer, or the galvanic plating layer, or the electrophoretic layer by means of PVD, such that the formed film layer has enhanced stability and abrasion resistance,

and the formed color is more durable with colorfastness.

[00213] 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 first layer (2) and a second layer (3) sequentially attached on the precious metal base (1), the first layer (2) formed on the surface of the precious metal base (1), and the second layer (3) deposited on the first layer (2); wherein the first layer (2) is any one of a physical vapor deposition layer, a galvanic plating layer and an electrophoretic layer, the second layer (3) is a transparent film layer, and the precious metal is gold or silver; wherein the transparent film layer is made of fluoride.

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, wherein the physical vapor deposition layer has a thickness within a range of 10nm-50 μ m; preferably, the material of the physical vapor deposition layer is one or more selected from the group consisting of Ni, Ti, Zn, Cr, Mg, Nb, Sn, Al, In, Fe, Zr, Si, Cu, Ta, Ge, Ag, Co, Au, Gd, La, Y, Ce, W, Hf, Mo, CrN, TiN,

TiAlCN, TiCN, TiAlN, AlTiN, TiB₂, ZrN, FeCo, AlSi, TiSi, CrSi, ZnAl, TiZn, TiAl, TiZr, TiSi, TiNi, NiAl, NiV, NiFe, gold-copper alloy and diamond-like carbon (DLC); preferably gold-copper alloy; preferably, the physical vapor deposition layer has a single pure color or a mottled color; preferably, the surface of the physical vapor deposition layer is a plane, or a concave surface or a convex surface.

4. The precious metal article of claim 1, wherein the galvanic plating layer has a thickness of 0.05-50μm, preferably 0.1-1.5μm, and the material of the galvanic plating layer is a gold-copper alloy.

5. The precious metal article of claim 1, wherein the transparent film layer has a thickness of 0.0001-10μm, preferably 0.0005-0.1μm; preferably, the fluoride is an AF pill.

6. The precious metal article of claim 1, wherein the electrophoretic layer has a thickness within a range of 0.1-20μm.

7. A method for preparing the precious metal article of any one of claims 1-6 comprising the following steps:

(1) forming a first layer (2) on the surface of the precious metal base (1);

(2) depositing a second layer (3) on the first layer (2) by using physical vapor deposition;

wherein the physical vapor deposition layer is deposited on the surface of the precious metal base (1) by means of physical vapor deposition; or the galvanic plating layer is formed on the surface of the precious metal base (1) by means of a galvanic plating process; or the electrophoretic layer is formed on the surface of the precious metal base (1) by means of an electrophoretic process;

wherein the second layer (3) is a transparent film layer, and the transparent film layer is made of fluoride.

8. The method of claim 7, wherein in step (1), a physical vapor deposition layer is deposited on the surface of the precious metal base (1) by means of physical vapor deposition, wherein the physical vapor deposition mode is vacuum evaporation plating, vacuum sputtering coating or vacuum ion plating;

preferably, the physical vapor deposition mode is vacuum ion plating; more preferably, the vacuum ion plating comprises the following steps: heating the precious metal base (1) under the vacuum conditions, activating a metal target, and injecting a gas, applying a bias voltage, and plating film on the surface of the precious metal base (1);

wherein, the vacuum conditions comprises a vacuum degree of $1 \times 10^{-2} \text{Pa}$ -

9.5×10^{-4} Pa, the heating temperature is within a range of 50-260°C, and the time of plating film is within a range of 2-2,000min; wherein the metal target uses a metal which is at least one 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 alloy;

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; wherein the protective gas has a gas flow within a range of 20-200sccm; the toning gas has a gas flow within a range of 50-500sccm;

wherein applied bias voltage is 10-150V, and the duty ratio is 10-80%; wherein the target material currents of the metal target are as follows: the current of column target is within a range of 3-120A, the current of arc target is within a range of 50-200A;

preferably in step (1), the physical vapor deposition layer is deposited on the surface of the precious metal base (1) by physical vapor deposition, the process further comprises performing vacuumization prior to depositing the physical vapor deposition layer on the surface of the precious metal

base (1), wherein the vacuum degree during the vacuumization process is within a range of $1.0 \times 10^{-2} \text{Pa}$ - $7.0 \times 10^{-3} \text{Pa}$.

9. The method of claim 7, wherein in step (1), the galvanic plating layer is formed on the surface of the precious metal base (1) by using a galvanic plating process, wherein the galvanic plating conditions comprise a galvanic plating current of 0.5-0.9A, a temperature of 50-80°C, and a galvanic plating time of 1-30 min;

preferably in step (1), an electrophoretic layer is formed on the surface of the precious metal base (1) by using an electrophoresis process, wherein the electrophoresis conditions comprise: the electrophoresis includes a cathode electrophoresis and an anode electrophoresis, a direct current (DC) voltage of 100-200V, and an electrophoresis time of 1-10min.

10. The method of claim 7, wherein in step (2), the physical vapor deposition mode is vacuum evaporation plating, vacuum sputtering coating or vacuum ion plating;

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

preferably, the vacuum evaporation plating mode comprises the following steps: activating current of the evaporation source, evaporating the fluoride to form a transparent film layer;

preferably, the vacuum evaporation plating mode comprises the following steps: adjusting the vacuum degree to be within a range of 1.8×10^{-2} - 2.2×10^{-2} Pa such that the intra-furnace environment is suitable for electroplating; injecting argon gas with an argon gas flow rate of 55-65sccm, adjusting the vacuum degree to be within a range of 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 be within a range of 3.8×10^{-1} - 4.2×10^{-1} Pa; activating an aluminum target and a silicon target and operating for 80-100s and 170-190s, respectively; then shutting off the power sources of the aluminum target and the silicon target; activating a power supply of an evaporation source such that the current of a silicon target is within a range of 2.8-3.2A; evaporating for 170-190s under the condition that the current of an evaporation source is within a range of 700-740A; then evaporating for 170-190s under the condition that the current of an evaporation source is within a range of 750-800A; subsequently evaporating for 410-430s under the condition that the current of an evaporation source is within a range of 800-900A; thereby forming a transparent film having a thickness of 0.0001-10 μ m.

11. The method of claim 7, wherein a glow cleaning is performed in step (1) and/or step (2) prior to the physical vapor deposition, wherein the conditions of glow cleaning comprises an argon gas flow rate within a

range of 100-320sccm, an applied bias voltage of 380-1,000V, a duty ratio of 10-80%, and a time of 160-720s.

12. The method of claim 7, wherein the method further comprises cleaning the surface of the precious metal base (1) prior to step (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; preferably, 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.