CLAIMS

1. A method for preparing a metal material composed of endogenous alloy powder and wrapping body, which is prepared by the following steps:

at step 1: melting initial alloy melt with the main elementary composition of $M_{a0}A_{b0}T_{c0}$,

wherein M includes at least one of W, Cr, Mo, V, Ta, Nb, Zr, Hf, Ti, Fe, Co, Ni, Mn, Cu, Ag, Ir, Ru, Re, Os, and Tc;

A includes at least one of Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Mg, Ca, Li, Na, K, In, Pb, Zn, and Cu;

when M includes at least one of W, Cr, Mo, V, Ta, Nb, Zr, Hf, Ti, Fe, Co, Ni, Mn, Cu, and Ag, and A includes at least one of Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Mg, Ca, Li, Na, K, In, Pb, and Zn;

when M includes at least one of Ir, Ru, Re, Os, Tc, W, Cr, Mo, V, Ta, and Nb, and A includes Cu; and

wherein a0, b0, and c0 represent the atomic percent contents of corresponding constituent elements respectively, and a0+b0+c0=100%, and $0<c0\leq 15\%$;

at step 2: solidifying the $M_{a0}A_{b0}T_{c0}$ initial alloy melt into a solid state, thus obtaining dispersed $M_{a1}A_{b1}T_{c1}$ particle phase endogenously precipitated from the melt and $A_{b2}T_{c2}$ matrix phase wrapping the dispersed particles, the as-obtained solid material is the metal material composed of endogenous alloy powder and wrapping body; among which $0<c1<c0<c2$, it means that the content of element T in the $M_{a0}A_{b0}T_{c0}$ initial alloy melt is higher than that in the dispersed $M_{a1}A_{b1}T_{c1}$ particle phase, but lower than that in the $A_{b2}T_{c2}$ matrix phase;

the metal material composed of endogenous alloy powder and wrapping body is prepared by solidification of the alloy melt, and the structure of the metal material includes the dispersed particle phase endogenously precipitated during the solidification of the initial alloy and the matrix phase wrapping the dispersed particles, which correspond to the endogenous alloy powder and the wrapping body, respectively; the major elementary composition of the endogenous alloy powder is $M_{a1}A_{b1}T_{c1}$, and the major element composition of the wrapping body is $A_{b2}T_{c2}$;

both M and A contain one or more metal elements, T is an impurity element including oxygen, a1, b1, c1, b2, and c2 represent atomic percentage contents of the corresponding element respectively, and a1+b1+c1=100%, b2+c2=100%, $c2>c1>0$, $b1>0$; the melting point of the endogenous alloy powder is higher than that of the wrapping body; the endogenous $M_{a1}A_{b1}T_{c1}$ alloy powder contains element A in a solid solution;

the M and A comprise a pair or pairs of M^1-A^1 element combinations that will not form corresponding intermetallic compounds, wherein M^1 represents any single element in M and A^1 represents any single element in A, the main elements in M are composed of each M^1 element that satisfies the combination conditions of M^1-A^1, and the main elements in A are composed of each A^1 element that satisfies the combination conditions of M^1-A^1, so that the metal material composed of endogenous alloy powder and wrapping body will not form intermetallic compounds composed of the main elements in M and

the main elements in A after being completely melted and re-solidified, but form the endogenous $M_{a1}A_{b1}T_{c1}$ alloy powder and the $A_{b2}T_{c2}$ wrapping body.

2. The method for preparing a metal material composed of endogenous alloy powder and wrapping body according to claim 1, wherein the shape of the metal material composed of endogenous alloy powder and wrapping body is related to the solidification methods: in the case of continuous casting, its shape is mainly lath shape; in the case of melt spinning, its shape is mainly ribbon or sheet shape; and in the case of melt extraction, its shape is mainly wire shape.

3. The method for preparing a metal material composed of endogenous alloy powder and wrapping body according to claim 1, wherein T is the collection of O, H, N, P, S, F, and Cl elements, and T includes O, and $0<c1\leq1.5\%$.

4. The method for preparing a metal material composed of endogenous alloy powder and wrapping body according to claim 1, wherein the metal material composed of endogenous alloy powder and wrapping body is a metal material ribbon composed of endogenous alloy powder and wrapping body with a thickness of 10μm～5mm, and the particle size of the endogenous alloy powder is in a range of 3nm to 200μm.

5. The method for preparing a metal material composed of endogenous alloy powder and wrapping body according to claim 1, wherein $0<b1\leq15\%$.

6. The method for preparing a metal material composed of endogenous alloy powder and wrapping body according to claim 1, wherein the number of mono-crystalline particles in the endogenous alloy powder accounts for more than 60% of the total number of the particles.

7. The method for preparing a metal material composed of endogenous alloy powder and wrapping body according to claim 1, wherein the $M_{a0}A_{b0}T_{c0}$ initial alloy melt is prepared by melting alloy raw materials that comprise the first and the second raw materials; the major elementary composition of the first raw material is $M_{d1}T_{e1}$, and the major element composition of the second raw material is $A_{d2}T_{e2}$, d1, e1, d2, and e2 represent atomic percentage contents of the corresponding constituent elements respectively, and $0<e1\leq10\%$, $0<e2\leq10\%$, $d1+e1=100\%$, $d2+e2=100\%$.

8. The method for preparing a metal material composed of endogenous alloy powder and wrapping body according to claim 7, wherein the content of impurity T in endogenous $M_{a1}A_{b1}T_{c1}$ alloy powder is greatly reduced compared with that of $M_{d1}T_{e1}$ raw materials, that is, c1 is less than e1.

9. The method for preparing a metal material composed of endogenous alloy powder and wrapping body according to claim 7, wherein, in the metal material composed of endogenous alloy powder and wrapping body, the volume percentage of the endogenous $M_{a1}A_{b1}T_{c1}$ alloy powder is equivalent to the volume percentage of the $M_{d1}T_{e1}$ raw material during the raw materials preparation process.

10.The method for preparing a metal material composed of endogenous alloy powder and wrapping body according to claim 1, wherein the lower limit of the volume percentage content of the endogenous alloy powder in the metal material composed of endogenous alloy powder and wrapping body is 1%, and the upper limit is the volume percentage content that the endogenous alloy powder can be dispersively distributed in the wrapping body.

11.The method for preparing a metal material composed of endogenous alloy powder and wrapping body according to claim 1, wherein the volume percentage content of the endogenous alloy powder in the metal material composed of endogenous alloy powder and wrapping body ranges from 1% to 50%.

12.A method for preparing alloy powder, wherein the alloy powder is prepared by removing the wrapping body part of the metal material composed of endogenous alloy powder and wrapping body which is prepared by any of the methods according to claims 1 to 11, while retaining the endogenous alloy powder which cannot be simultaneously removed.

13.The method for preparing alloy powder according to claim 12, wherein the methods for removing the wrapping body while retaining the endogenous alloy powder include at least one of an acid solution dissolution reaction for removal, an alkali solution dissolution reaction for removal, a vacuum volatilization for removal, and a wrapping body natural oxidation-powdering peeling removal.

14.The method for preparing alloy powder according to claim 12, wherein M includes Fe, and A includes La, the metal material composed of endogenous alloy powder and wrapping body is a metal ribbon formed by the endogenous Fe alloy powder and La wrapping body, the endogenous Fe alloy powder contains element La in solid solution, through the natural oxidation-powdering peeling of the La wrapping body, the endogenous Fe alloy powder is pre-separated from the oxide powder of La matrix, then based on the magnetic properties of the Fe alloy powder, the magnetic field is used to separate the Fe alloy powder and the oxide powder of La matrix.

15.The method for preparing alloy powder according to claim 12, wherein the particle size of the

alloy powder ranges from 3nm to 10mm.

16.A method for preparing spherical or sub-spherical alloy powder, wherein the spherical or sub-spherical alloy powder is prepared through a plasma spheroidization treatment of the alloy powder according to claim 12.

17.The method for preparing spherical or sub-spherical alloy powder according to claim 16, wherein before the plasma spheroidization treatment the selected particles are subject to jet mill pre-crushing treatment and/or screening treatment.

18.A metal material composed of endogenous alloy powder and wrapping body, wherein the metal material composed of endogenous alloy powder and wrapping body is prepared by any one of the preparation methods of metal material composed of endogenous alloy powder and wrapping body according to claims 1 to 11.

19.An alloy powder, wherein the alloy powder is prepared by the method for preparing alloy powder according to claim 12.

20.A spherical or sub-spherical alloy powder, wherein the spherical or sub-spherical alloy powder is prepared by the method for preparing spherical or sub-spherical alloy powder according to claim 16.

21.An application of the metal material composed of endogenous alloy powder and wrapping body in coatings and composite materials, wherein the metal material composed of endogenous alloy powder and wrapping body is prepared by any one of the preparation methods of metal material composed of endogenous alloy powder and wrapping body according to claims 1 to 11.

22.The application of a metal material composed of endogenous alloy powder and wrapping body in coatings and composite materials according to claim 21, wherein after the preparation of the metal material composed of endogenous alloy powder and wrapping body, the wrapping body is not removed immediately, and subsequently, the endogenous alloy powder is tried to be protected in other ways from being contaminated by impurities such as oxygen, but the wrapping body is directly used to protect the endogenous powder from being naturally oxidized;
such metal material composed of the endogenous powder and the wrapping body can be directly used as a raw material for downstream production;
when the endogenous powder is needed for downstream production, based on the characteristics of the next working procedure, the endogenous powders are released from the wrapping body in the shortest possible time, so that the chance of contamination of the alloy powder is greatly reduced.

23.The application of a metal material composed of endogenous alloy powder and wrapping body in coatings and composite materials according to claim 21, wherein the metal material composed of endogenous alloy powder and wrapping body with the average particle size of the endogenous alloy powder lower than 1000nm is selected and its wrapping body is removed; the obtained alloy powder is mixed with other components of the coatings or composite materials at the same time or immediately after the removal of the wrapping body, so as to reduce the content of impurities including O, which is newly introduced on the surface of the alloy powder due to the exposure of the alloy powder surface; thus coatings or composite materials added with high-purity, ultra-fine and high-activity alloy powder can be obtained, which can be applied in various fields including anti-bacterial coatings, weather-proof coatings, camouflage coatings, wave-absorbing coatings, wear-resistant coatings, anti-corrosive coatings, and resin-based composites.

24.An application of the alloy powder in powder metallurgy, metal injection molding, magnetic materials, and coatings, wherein the alloy powder is prepared by the method for preparing alloy powder according to claim 12.

25.An application of the alloy powder in catalysis, sterilization, metal powder 3D printing, and composite materials, wherein the alloy powder is prepared by the method for preparing alloy powder according to claim 12.

26.An application of the spherical or sub-spherical alloy powder in powder metallurgy, metal injection molding, and metal powder 3D printing, wherein the spherical or sub-spherical alloy powder is prepared by the method for preparing spherical or sub-spherical alloy powder according to claim 16.

27.A metal material composed of endogenous alloy powder and wrapping body, wherein the metal material is prepared by solidification of an alloy melt, and a structure of the metal material includes a dispersed particle phase endogenously precipitated during solidification of the initial alloy and the matrix phase wrapping the dispersed particles, which correspond to the endogenous alloy powder and the wrapping body, respectively; the major elementary composition of the endogenous alloy powder is $M_{a1}A_{b1}T_{c1}$, and the major elementary composition of the wrapping body is $A_{b2}T_{c2}$; both M and A contain one or more metal elements, T is an impurity element including oxygen, wherein M includes at least one of W, Cr, Mo, V, Ta, Nb, Zr, Hf, Ti, Fe, Co, Ni, Mn, Cu, Ag, Ir, Ru, Re, Os, and Tc; A includes at least one of Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Mg, Ca, Li, Na, K, In, Pb, Zn, and Cu; wherein when M includes at least one of W, Cr, Mo, V, Ta, Nb, Zr, Hf, Ti, Fe, Co, Ni, Mn, Cu, and Ag, and A includes at least one of Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy,

Ho, Er, Tm, Yb, Lu, Mg, Ca, Li, Na, K, In, Pb, and Zn; when M includes at least one of Ir, Ru, Re, Os, Tc, W, Cr, Mo, V, Ta, and Nb, and A includes Cu; wherein a1, b1, c1, b2, and c2 represent atomic percentage contents of the corresponding element respectively, and a1+b1+c1=100%, b2+c2=100%, c2>c1>0, b1>0; the melting point of the endogenous alloy powder is higher than that of the wrapping body; the endogenous $M_{a1}A_{b1}T_{c1}$ alloy powder contains element A in a solid solution; the M and A comprise a pair or pairs of M^1-A^1 element combinations that will not form corresponding intermetallic compounds, wherein M^1 represents any single element in M and A^1 represents any single element in A, the main elements in M are composed of each M^1 element that satisfies the combination conditions of M^1-A^1, and the main elements in A are composed of each A^1 element that satisfies the combination conditions of M^1-A^1, so that the metal material composed of endogenous alloy powder and wrapping body will not form intermetallic compounds composed of the main elements in M and the main elements in A after being completely melted and re-solidified, but form the endogenous $M_{a1}A_{b1}T_{c1}$ alloy powder and the $A_{b2}T_{c2}$ wrapping body.

28.The metal material composed of endogenous alloy powder and wrapping body according to claim 27, wherein T is the collection of O, H, N, P, S, F, Cl elements, and T includes O and $0<c1\leq1.5\%$, and $0<b1\leq15\%$.

29.An alloy powder, wherein the alloy powder is prepared by removing the wrapping body in any one of the metal materials composed of endogenous alloy powder and wrapping body according to claim 27 and claim 28, and its major elementary composition is $M_{a3}A_{b3}T_{c3}$, a3, b3, and c3 represent atomic percentage contents of the corresponding elementary compositions respectively, b3>0, a3+b3+c3=100%, and the content of element T in the alloy powder is higher than that in any one of the endogenous alloy powder according to claim 27 and 28, that is, c3>c1>0.

30.A spherical or sub-spherical alloy powder, wherein the spherical or sub-spherical alloy powder is prepared through a plasma spheroidization treatment of the alloy powder according to claim 29, and its major elementary composition is $M_{a4}A_{b4}T_{c4}$, a4, b4, and c4 represent atomic percentage contents of the corresponding elementary compositions respectively, b4>0, a4+b4+c4=100%, and the content of element T in the spherical or sub-spherical alloy powder is higher than that in the alloy powder without plasma spheroidization treatment, that is, c4>c3>c1>0.

31.A method for preparing a metal material composed of endogenous alloy powder and wrapping body, which is prepared by the following steps:
(1) melting initial alloy melt with the main elementary composition of $M_{a0}A_{b0}T_{c0}$, wherein both M and A contain one or more metal elements, T is the impurity element including oxygen, a0, b0, and c0 represent atomic percentage contents of the corresponding element respectively, a0+b0+c0=100%,

0<c0; the M and A comprise a pair or pairs of M^1-A^1 element combinations that will not form corresponding intermetallic compounds, wherein M^1 represents any single element in M and A^1 represents any single element in A, and the main elements in M are composed of each M^1 element that satisfies the combination conditions of M^1-A^1, and the main elements in A are composed of each A^1 element that satisfies the combination conditions of M^1-A^1,

(2) solidifying the $M_{a0}A_{b0}T_{c0}$ initial alloy melt into a solid state, thus obtaining dispersed $M_{a1}A_{b1}T_{c1}$ particle phase endogenously precipitated from the melt and $A_{b2}T_{c2}$ matrix phase wrapping the dispersed particles, which are the metal material composed of endogenous alloy powder and wrapping body according to any one of claims 27 and 28, and 0<c1<c0<c2.

32.The method for preparing a metal material composed of endogenous alloy powder and wrapping body according to claim 31, wherein the $M_{a0}A_{b0}T_{c0}$ initial alloy melt is prepared by melting alloy raw materials that comprise the first and the second raw materials; the major elementary composition of the first raw material is $M_{d1}T_{e1}$, and the major element composition of the second raw material is $A_{d2}T_{e2}$, d1, e1, d2, and e2 represent atomic percentage contents of the corresponding constituent elements respectively, and 0<e1≤10%, 0<e2≤10%, d1+e1=100%, d2+e2=100%.

33.A method for preparing alloy powder, wherein the alloy powder is prepared by removing the wrapping body part of the metal material composed of endogenous alloy powder and wrapping body according to claims 27 to 28, while retaining the endogenous alloy powder which cannot be simultaneously removed.

34.An application of the alloy powder according to claim 29, or the alloy powder prepared by the preparation method according to claim 33 in powder metallurgy, metal injection molding, magnetic materials, and coatings.

35.An application of the spherical or sub-spherical alloy powder according to claim 30 in powder metallurgy, metal injection molding, and metal powder 3D printing.

36.An application of the metal material composed of endogenous alloy powder and wrapping body according to any one of claims 27 to 28, or the metal material composed of endogenous alloy powder and wrapping body prepared by the preparation method according to any one of claims 31 to 32 in coatings and composite materials.