WHAT IS CLAIMED IS:

1. A preparation method of the double-shell neodymium-iron-boron magnet, comprising the steps of:

S1: preparing a main alloy sheet, a first auxiliary alloy sheet and a second auxiliary alloy sheet respectively;

wherein, the raw material for the main alloy sheet comprises LH_3, X_3, Y_3, Fe and B, wherein the LH_3 is Pr and/or Nd; the X_3 is one or more of Zr, Ti and Nb; the Y_3 is one or more of Cu, Al, Ga and Co, and the Y_3 must comprise Cu; and in the main alloy sheet, the LH_3 accounts for 27-35% by mass of the main alloy sheet, the X_3 accounts for 0.05-0.8% by mass of the main alloy sheet, wherein the sum of the mass percentages of respective elements in the main alloy sheet is 100%,

the raw material for the first auxiliary alloy sheet comprises LH_1, RH_1, X_1 and Fe, wherein the LH_1 is one or more of La, Ce, Pr and Nd; the RH_1 is Ho and/or Gd; the X_1 is one or more of Cu, Co, Ga and Al; in the first auxiliary alloy sheet, the LH_1 accounts for 0-80% by mass of the first auxiliary alloy sheet, the RH_1 accounts for 5-80% by mass of the first auxiliary alloy sheet, the total amount of LH_1 and RH_1 accounts for 30% by mass or more of the first auxiliary alloy sheet, and the X_1 accounts for 1-15% by mass of the first auxiliary alloy sheet, wherein the sum of the mass percentages of respective elements in the first auxiliary alloy sheet is 100%;

the raw material for the second auxiliary alloy sheet comprises RH_2, X_2 and Fe, wherein the RH_2 is Dy and/or Tb, the X_2 is Zr and/or Ti; in the second auxiliary alloy sheet, the RH_2 accounts for 0-80% by mass, excluding 0% by mass of the second auxiliary alloy sheet, and the X_2 accounts for 3-10% by mass of the second auxiliary alloy sheet, wherein the sum of the mass percentages of respective elements in the second auxiliary alloy sheet is 100%;

S2: subjecting a mixture, which is obtained by hydrogen decrepitating or pulverizing the main alloy sheet, the first auxiliary alloy sheet and the second auxiliary alloy sheet, to a shaping and sintering treatments to achieve the double-shell neodymium-iron-boron magnet.

2. The preparation method of the double-shell neodymium-iron-boron magnet according to claim 1, wherein:

in S1, the LH_1 accounts for 0-60% by mass, excluding 0% by mass, for example 30% by mass of the first auxiliary alloy sheet; and/or

in S1, the LH_1 is Pr and/or Nd; and/or

in S1, when the raw material for the first auxiliary alloy sheet comprises Pr, the Pr accounts for 0-60% by mass, for example, 7.5% by mass of the first auxiliary alloy sheet; and/or

in S1, when the raw material for the first auxiliary alloy sheet comprises Nd, the Nd accounts for 0-60% by mass, for example, 22.5% by mass of the first auxiliary alloy sheet; and/or

in S1, the RH_1 accounts for 20-50% by mass of the first auxiliary alloy sheet; and/or

in S1, the total amount of LH_1 and RH_1 accounts for 50% by mass or more of the first auxiliary alloy sheet; and/or

in S1, the X_1 is Cu and/or Co; and/or

in S1, the X_1 accounts for 5-12% by mass, preferably 5-10% by mass of the first auxiliary alloy sheet; and/or

in S1, when the X_1 comprises Cu, the Cu accounts for 1-6% by mass, for example, 5% by mass of the first auxiliary alloy sheet; and/or

in S1, when the X_1 comprises Co, the Co accounts for 1-6% by mass, for example, 5% by mass of the first auxiliary alloy sheet; and/or

in S1, in the first auxiliary alloy sheet, the Fe accounts for 50% by mass or less, preferably 39-45% by mass, for example, 39.5% by mass or 44.7% by mass of the first auxiliary alloy sheet; and/or

in S1, the raw material for the first auxiliary alloy sheet further comprises B, and in the first auxiliary alloy sheet, the B accounts for 0-0.6% by mass, excluding 0% by mass, for example 0.3% by mass or 0.5% by mass of the first auxiliary alloy sheet.

3. The preparation method of the double-shell neodymium-iron-boron magnet according to claim 2, wherein:

the raw material for the first auxiliary alloy is composed of the following components: Ho with a content of 50%; Cu with a content of 5%; Fe with a content of 44.7%; and B with a content of 0.3%, wherein the percentages refer to the mass percentages of the component in the raw materials for the first auxiliary alloy; or

the raw material for the first auxiliary alloy is composed of the following components: Pr with a content of 7.5%; Nd with a content of 22.5%; Ho with a content of 20%; Cu with a content of 5%; Co with a content of 5%; Fe with a content of 39.5%; and B with a content of 0.5%, wherein the percentages refer to the mass percentages of the components in the raw material for the first auxiliary alloy.

4. The preparation method of the double-shell neodymium-iron-boron magnet according to claim 1, wherein:

in S1, the RH_2 accounts for 50-80% by mass, for example, 58% by mass or 63% by mass of the second auxiliary alloy sheet; and/or

in S1, the X_2 accounts for 6-10% by mass of the second auxiliary alloy sheet; and/or

in S1, when the X_2 comprises Zr, the Zr accounts for 6-10% by mass of the second auxiliary alloy sheet; and/or

in S1, the raw material for the second auxiliary alloy sheet further comprises LH_2, the LH_2 is one or more of La, Ce, Pr, and Nd, and the LH_2 accounts for 80% by mass or less, excluding 0% by mass of the second auxiliary alloy sheet; and/or

in S1, the raw material for the second auxiliary alloy sheet further comprises B, and in the second auxiliary alloy sheet, the B accounts for 0-0.6% by mass, excluding 0% by mass, for example, 0.5% by mass of the second auxiliary alloy sheet.

5. The preparation method of the double-shell neodymium-iron-boron magnet according to claim 4, wherein:

the raw material for the second auxiliary alloy is composed of the following components: Dy with a content of 58%; Zr with a content of 6%; and Fe with a content of

36%, wherein the percentages refer to the mass percentages of the components in the raw material for the second auxiliary alloy; or

the raw material for the second auxiliary alloy is composed of the following components: Dy with a content of 63%; Zr with a content of 6%; Fe with a content of 30.5%; and B with a content of 0.5%, wherein the percentages refer to the mass percentages of the components in the raw material for the second auxiliary alloy; or

the raw material for the second auxiliary alloy is composed of the following components: Dy with a content of 58%; Zr with a content of 6%; Fe with a content of 35.5%; and B with a content of 0.5%, wherein the percentages refer to the mass percentages of the components in the raw material for the second auxiliary alloy.

6. The preparation method of the double-shell neodymium-iron-boron magnet according to claim 1, wherein:

in S1, the first auxiliary alloy sheet has a melting point which is lower than that of the second auxiliary alloy sheet.

7. The preparation method of the double-shell neodymium-iron-boron magnet according to claim 1, wherein:

the LH_3 accounts for 27-30% by mass, for example, 27.6% by mass, 28% by mass or 29% by mass of the main alloy sheet; and/or

the X_3 accounts for 0.1-0.6% by mass, preferably 0.2-0.3% by mass, for example 0.22% by mass of the main alloy sheet; and/or

the Y_3 accounts for 0.75-2.5% by mass, for example 1.15% by mass or 2.06% by mass of the main alloy sheet; and/or

in the main alloy sheet, the Cu accounts for 0.1-0.6% by mass, for example 0.21% by mass or 0.25% by mass of the main alloy sheet; and/or

in the main alloy sheet, when the Y_3 comprises Al, the Al accounts for 0.02-1.2% by mass, for example 0.4% by mass of the main alloy sheet; and/or

in the main alloy sheet, when the Y_3 comprises Ga, the Ga accounts for 0.25-0.4% by mass, for example 0.26% by mass of the main alloy sheet; and/or

in the main alloy sheet, when the Y_3 comprises Co, the Co accounts for 0.5-1.2% by mass, for example 1.19% by mass of the main alloy sheet; and/or

in the main alloy sheet, the B accounts for 0.97-1% by mass of the main alloy sheet; and/or

the raw material for the main alloy sheet further comprises RH_3, the RH_3 is Dy and/or Tb, and the RH_3 accounts for 0-3% by mass, excluding 0% by mass of the main alloy sheet;

preferably, the raw material for the main alloy is composed of the following components: Nd with a content of 27.6%; Dy with a content of 3%; Ga with a content of 0.26%; Al with a content of 0.4%; Cu with a content of 0.21%; Co with a content of 1.19%; Ti with a content of 0.2%; Nb with a content of 0.02%; B with a content of 1%; Fe with a content of 66.12%, wherein the percentages refer to the mass percentages of the components in the raw material for the main alloy; or

the raw material for the main alloy is composed of the following components: Pr with a content of 7%; Nd with a content of 21%; Dy with a content of 3%; Ga with a content of 0.4%; Cu with a content of 0.25%; Co with a content of 0.5%; Zr with a content of 0.2%; B with a content of 0.97%; and Fe with a content of 66.68%, wherein the percentages refer to the mass percentages of the components in the raw material for the main alloy; or

the raw material for the main alloy is composed of the following components: Pr with a content of 7.25%; Nd with a content of 21.75%; Dy with a content of 1%; Ga with a content of 0.4%; Cu with a content of 0.25%; Co with a content of 0.5%; Zr with a content of 0.2%; B with a content of 0.97%; Fe with a content of 67.68%, wherein the percentages refer to the mass percentages of the components in the raw material for the main alloy.

8. The preparation method of the double-shell neodymium-iron-boron magnet according to claim 1, wherein:

in S1, the first auxiliary alloy sheet is obtained by smelting and casting the raw material for the first auxiliary alloy sheet; preferably, the temperature for smelting the raw material for the first auxiliary alloy sheet is 1000°C or more; the casting for the first auxiliary alloy sheet is preferably a strip continuous casting process, an ingot casting process, a centrifugal casting process, or a rapid quenching process; and/or

in S1, the second auxiliary alloy sheet is obtained by smelting and casting the raw material for the second auxiliary alloy sheet; preferably, the temperature for smelting the raw material for the second auxiliary alloy sheet is 1300°C or more; the casting for the second auxiliary alloy sheet is preferably a strip continuous casting process, an ingot casting process, a centrifugal casting process, or a rapid quenching process; and/or

in S1, the main alloy sheet is obtained by smelting and casting the raw material for the main alloy sheet; preferably, the temperature for smelting the raw material for the main alloy sheet is 1400°C or more; the casting for the main alloy sheet is preferably a strip continuous casting process, an ingot casting process, a centrifugal casting process, or a rapid quenching process; and/or

in S2, the amount of the first auxiliary alloy sheet and the second auxiliary alloy sheet accounts for more than 1% by mass and less than 15% by mass, preferably 5% by mass of the amount of the raw material for the double-shell neodymium-iron-boron magnet; the raw material for the double-shell neodymium-iron-boron magnet comprises the main alloy sheet, the first auxiliary alloy sheet and the second auxiliary alloy sheet; and/or

in S2, a mixture of the main alloy sheet and the auxiliary alloy sheets is subjected to hydrogen decrepitation, pulverization, shaping and sintering treatments to obtain the double-shell neodymium-iron-boron magnet; or, the main alloy sheet and the auxiliary alloy sheets are subjected to hydrogen decrepitation respectively, then the coarse powders obtained after hydrogen decrepitating the main alloy sheet and the auxiliary alloy sheets are mixed, and then the mixed coarse powders are subjected to pulverization, shaping and sintering treatments to obtain the double-shell neodymium-iron-boron magnet; or, the main alloy sheet and the auxiliary alloy sheets are subjected to hydrogen decrepitation and pulverization respectively, then the coarse powders obtained after pulverizing the main alloy sheet and the auxiliary alloy sheets are mixed, and then the mixed coarse powders are subjected to shaping and sintering treatments to obtain the double-shell neodymium-iron-boron magnet; and/or

in S2, the hydrogen decrepitation has a dehydrogenation temperature of 400°C-650°C, for example, 500-620°C; and/or

in S2, the pulverization is jet mill pulverization; and/or

in S2, the pulverization is carried out under an atmosphere with an oxygen content of

50 ppm or less; and/or

in S2, the particles after the pulverization have a diameter of 2-7 μm, for example, 3.0-5.3 μm; and/or

in S2, the shaping comprises pressing into a green compact in a press with a magnetic field strength of 0.5T-3.0T, for example, 1.0-2.0T; and/or

in S2, the sintering temperature is 1000-1150°C, for example, 1050-1085°C.

9. A double-shell neodymium-iron-boron magnet obtainable by a method of any of the previous claims, comprising a main phase crystal grain, a double shell of the main phase crystal grain and an Nd-rich phase adjacent to the main phase crystal grain,

the main phase crystal grain comprises $R_2Fe_{14}B$, wherein the R is one or more of La, Ce, Pr and Nd;

the double shell has an inner layer comprising $(Nd/Ho)_2Fe_{14}B$ and/or $(Nd/Gd)_2Fe_{14}B$;

the double shell has an outer layer comprising $(Nd/Dy)_2Fe_{14}B$ and/or $(Nd/Tb)_2Fe_{14}B$;

the double shell has a thickness of 0.1-6 μm;

the Nd-rich phase comprises a $(R\text{-}RH)_6T_{13}X$ phase, wherein RH is one or more of Ho, Gd, Dy and Tb; T is Fe and/or Co; and X is one or more of Ga, Cu and Al.

10. The double-shell neodymium-iron-boron magnet according to claim 9, wherein the Nd-rich phase further comprises ZrB_2 and TiB_2.