METHOD FOR PREPARING IRON-COBALT-TANTALUM ALLOY POWDER

TECHNICAL FIELD

The present application relates to the technical field of alloy power preparation, for example, to a method for preparing an iron-cobalt-tantalum alloy powder, an iron-cobalt-tantalum alloy powder, and an application thereof.

BACKGROUND

With the rapid development of society and the rapid increase of demand for information storage, recording media using magnetic information storage technology, such as hard disks and optical disks, have been paid more and more attention and occupy a decisive position in the field of information storage due to their advantages of high storage density, large capacity, and low price. Magnetic recording is a way to record information by using magnetic properties, which can input and read information by special methods during storage and use, so as to achieve the purpose of information storage and read. According to the magnetization direction of the medium and the position relationship on the surface of the medium, the magnetic recording includes longitudinal magnetic recording and perpendicular magnetic recording.

At present, the perpendicular magnetic recording technology has completely replaced the longitudinal magnetic recording technology in the magnetic recording market. The perpendicular magnetic recording technology makes the area density and capacity of magnetic recording media increase rapidly, and common magnetic recording media include hard disks, magnetic disks, and optical disks. Therefore, the magnetic recording media generally adopt the design with a multi-layer perpendicular structure, and, taking hard disks as an example, specifically include a lubricating layer, a protective layer, a magnetic recording layer, an intermediate layer, a soft magnetic substrate layer, a substrate layer, and a base layer. The soft magnetic substrate layer mainly functions to record and store data and plays an important role in magnetic recording media. At present, iron-cobalt-tantalum alloy thin films obtained by the sputtering process are the most commonly used soft magnetic substrate layer.

Sputtering is one of the main techniques for preparing thin-film materials and is characterized in that ions generated by an ion source are accelerated and gathered in vacuum to form an ion beam flow with high speed energy, the ion beam flow bombards the surface of a solid so that

What is claimed is:

1. A method for preparing an iron-cobalt-tantalum alloy powder, comprising:

(1) preparing and mixing an iron material, a cobalt material, and a tantalum material according to a target atomic ratio to obtain an iron-cobalt-tantalum mixture;

(2) completely melting the iron-cobalt-tantalum mixture obtained in step (1) at a temperature of 1650℃ to 1750℃ to obtain an iron-cobalt-tantalum melt; and

(3) atomizing the iron-cobalt-tantalum melt obtained in step (2) under the action of an inert gas to obtain the iron-cobalt-tantalum alloy powder;

wherein the mixing in step (1) is performed in a melting crucible in a manner of layering and superposition, which specifically comprises:

paving the cobalt material on the bottom of the melting crucible, paving the tantalum material on the cobalt material, and paving the iron material on the tantalum material to form a cobalt-tantalum-iron material-paving unit, and repeating the above operations according to the cobalt-tantalum-iron material-paving unit until the loading is completed.

2. The preparation method according to claim 1, wherein in the target atomic ratio in step (1), the atomic ratio of cobalt is 28.5% to 29.5%, the atomic ratio of tantalum is 17.5% to 18.5%, and the remainder is iron and unavoidable impurities.

3. The preparation method according to claim 1 or 2, wherein the iron material in step (1) has a purity of greater than or equal to 99.95%.

4. The preparation method according to any one of claims 1 to 3, wherein the iron material in step (1) is an electrolytic iron material;

optionally, the cobalt material in step (1) has a purity of greater than or equal to 99.95%;

optionally, the cobalt material in step (1) is an electrolytic cobalt material;

optionally, the tantalum material in step (1) has a purity of greater than or equal to 99.95%; and

optionally, the tantalum material in step (1) is a tantalum scrap of a tantalum target material.

5. The preparation method according to any one of claims 1 to 4, wherein, before preparing the iron material, the cobalt material, and the tantalum material according to the target atomic ratio in step (1), further comprising: pretreating the iron material, the cobalt material, and the

tantalum material respectively;

optionally, the pretreatment sequentially comprises deoiling, acid pickling, drying, and vacuum packaging;

optionally, the deoiling comprises the following steps: putting the iron material, the cobalt material, and the tantalum material into a cleaning liquid respectively for ultrasonic cleaning, washing the iron material, the cobalt material, and the tantalum material with pure water, and wiping the iron material, the cobalt material, and the tantalum material clean;

optionally, the cleaning liquid is an aqueous solution containing a detergent;

optionally, the ultrasonic cleaning is performed for 50 minutes to 70 minutes;

optionally, the ultrasonic cleaning is performed at a temperature of 50℃ to 70℃;

optionally, the acid pickling comprises the following steps: putting the iron material, the cobalt material, and the tantalum material into a pickling solution for ultrasonic cleaning, washing the iron material, the cobalt material, and the tantalum material with pure water, and wiping the iron material, the cobalt material, and the tantalum material clean;

optionally, the pickling solution is an aqueous solution of nitric acid and hydrofluoric acid;

optionally, the nitric acid and hydrofluoric acid in the pickling solution are 38.5% and 7.1% respectively, based on percentage by mass;

optionally, the acid pickling is performed for 10 minutes to 30 minutes;

optionally, the drying is performed in a vacuum-drying oven;

optionally, the drying is performed for 60 minutes to 90 minutes; and

optionally, the drying is performed at a temperature of 65℃ to 80℃.

6. The preparation method according to any one of claims 1 to 5, wherein the melting in step (2) is performed at an absolute vacuum degree of less than or equal to 10 Pa; and

optionally, the melting in step (2) is performed in a vacuum melting chamber, and then the iron-cobalt-tantalum melt is poured into a tundish, wherein the tundish is controlled to be at a temperature of 1550℃ to 1650℃.

7. The preparation method according to any one of claims 1 to 6, wherein the inert gas in step (3) is argon gas;

optionally, the argon gas has a purity of greater than or equal to 5N; and

optionally, the atomizing in step (3) is performed at a pressure of 3 MPa to 4 MPa.

8. The preparation method according to any one of claims 1 to 7, comprising the following steps:

(1) preparing the pretreated iron material, cobalt material, and tantalum material according to a target atomic ratio, and mixing the iron material, the cobalt material, and the tantalum material in a melting crucible in a manner of layering and superposition, wherein step (1) specifically comprises the following steps: paving the cobalt material on the bottom of the melting crucible, paving the tantalum material on the cobalt material, paving the iron material on the tantalum material to form a cobalt-tantalum-iron material-paving unit, and repeating the above operations according to the cobalt-tantalum-iron material-paving unit until the loading is completed, so as to obtain the iron-cobalt-tantalum mixture;

wherein in the target atomic ratio, the atomic ratio of cobalt is 28.5% to 29.5%, the atomic ratio of tantalum is 17.5% to 18.5%, and the remainder is iron and unavoidable impurities;

the iron material has a purity of greater than or equal to 99.95%, the cobalt material has a purity of greater than or equal to 99.95%, and the tantalum material has a purity of greater than or equal to 99.95%; and

the pretreatment sequentially comprises deoiling, acid pickling, drying, and vacuum packaging;

(2) putting the iron-cobalt-tantalum mixture obtained in step (1) into a vacuum melting chamber with an absolute vacuum degree controlled to be less than or equal to 10 Pa, and completely melting the iron-cobalt-tantalum mixture at 1650℃ to 1750℃ to obtain an iron-cobalt-tantalum melt; and

(3) pouring the iron-cobalt-tantalum melt obtained in step (2) into a tundish whose temperature is controlled to be 1550℃ to 1650℃, and performing atomization under the action of argon gas with a purity of greater than or equal to 5N at a pressure controlled to be 3 MPa to 4 MPa, so as to obtain the iron-cobalt-tantalum alloy powder.