METHODS AND SYSTEMS OF ADJUSTING TILT USING MAGNETIC ERASE WIDTH FEEDBACK

BACKGROUND

[0001] Magnetic storage devices such as hard disk drives use magnetic media to store data and a movable slider having magnetic transducers (e.g., read/write heads) positioned over the magnetic media to selectively read data from and write data to the magnetic media. Electronic lapping guides (ELGs) are used for precisely controlling a degree of lapping applied to an air bearing surface (ABS) of the sliders for achieving a particular stripe height, or distance from the ABS, for the magnetic transducers located on the sliders. U.S. Patent No. 8,165,709 to Rudy and U.S. Patent No. 8,151,441 to Rudy et al., which are incorporated herein by reference in their entirety, provide a comprehensive description of ELGs used in manufacturing sliders for hard disk drives.

[0002] As the design of magnetic transducers becomes more and more intricate, their fabrication processes become increasingly complex as well. Such complex fabrication processes inherently include some imperfections that ultimately manifest as undesirable variations in the final product. By observing certain performance parameters of the final product (e.g., sliders including one or more magnetic transducers), these undesirable variations can be measured and quantified. A system and method for reducing or eliminating these undesirable variations in the performance of magnetic transducers is therefore needed.

SUMMARY

[0002a] In one aspect, there is provided a method of manufacturing a magneto-resistive device, comprising: extracting a first subset of bars and a second subset of bars from a first bar section of a wafer, the wafer including a plurality of bar sections stacked in a first direction, wherein each bar section extends in a second direction substantially perpendicular to the first direction, wherein each bar section of the plurality of bar sections includes a plurality of bars that are adjacent to one another, and wherein the first subset of bars includes at least two bars; obtaining a magnetic performance of the first subset of the bars; determining, for the second subset of bars, an angle based on the magnetic performance, wherein the determined angle comprises an air bearing surface (ABS) tilt angle of the second

subset of bars optimizing the magnetic performance of the magneto-resistive device; and processing the second subset of bars from the first bar section of the wafer based on the determined angle such that the ABS tilt angle of the second subset of bars is different than an ABS tilt angle of the first subset of bars.

[0002b] In another aspect, there is provided a method of manufacturing a magnetic device, comprising: slicing and dividing a wafer into bar sections stacked in a first direction, wherein each bar section extends in a second direction substantially perpendicular to the first direction, wherein each bar section of the plurality of bar sections includes a plurality of bars that are adjacent to one another, and wherein the first subset of bars includes at least two bars; grinding and slicing a first subset of bars of a bar section, the first subset of bars including at least two bars; obtaining magnetic erase width (MEW) of the first subset of bars, and determining an air bearing surface (ABS) tilt angle for a second subset of bars of the bar section based on the (MEW); and grinding and slicing a second subset of bars of the bar section based on the ABS tilt angle such that the first and second subsets of bars have different ABS tilt angles.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] The present invention is illustrated by way of example, and not limitation, in the figures of the accompanying drawings in which:

[0004] Figures 1A and 1B illustrate an example of a conventional magnetic disk drive in which a magnetic read element manufactured in accordance with various embodiments may be utilized;

[0005] Figure 1C illustrates an example of a conventional read/write head.

[0006] Figure 2 is an operational flow chart illustrating a conventional process for manufacturing a magnetic read element;

CLAIMS

What is claimed is:

1. A method of manufacturing a magneto-resistive device, comprising:

extracting a first subset of bars and a second subset of bars from a first bar section of a wafer, the wafer including a plurality of bar sections stacked in a first direction, wherein each bar section extends in a second direction substantially perpendicular to the first direction, wherein each bar section of the plurality of bar sections includes a plurality of bars that are adjacent to one another, and wherein the first subset of bars includes at least two bars;

obtaining a magnetic performance of the first subset of the bars;

determining, for the second subset of bars, an angle based on the magnetic performance, wherein the determined angle comprises an air bearing surface (ABS) tilt angle of the second subset of bars optimizing the magnetic performance of the magneto-resistive device; and

processing the second subset of bars from the first bar section of the wafer based on the determined angle such that the ABS tilt angle of the second subset of bars is different than an ABS tilt angle of the first subset of bars.

2. The method of claim 1, wherein the first subset of bars extracted from the first bar section of the wafer comprises a top bar extracted from a top portion of the first bar section, a middle bar extracted from a middle portion of the first bar section, and a bottom bar extracted from a bottom portion of the first bar section.

3. The method of claim 1, wherein obtaining the magnetic performance comprises determining a magnetic erase width profile of the at least one subset of bars.

4. The method of claim 1, wherein the magneto-resistive device comprises a magnetic read head.

5. The method of claim 1, wherein the determined angle comprises a 90 degree angle having a variance up to +/- 0.5 degrees.

6. The method of claim 1, wherein the processing of the second subset of bars comprises grinding and slicing the second subset of bars at the determined angle.

7. The method of claim of claim 6, wherein the processing of the second subset of bars further comprises subjecting the second subset of bars to a second lapping process to fine-tune an ABS perpendicularity of the second subset of bars.

8. The method of claim 1, wherein the magneto-resistive device comprises a magnetic read head.

9. A method of manufacturing a magnetic device, comprising:

slicing and dividing a wafer into bar sections stacked in a first direction, wherein each bar section extends in a second direction substantially perpendicular to the first direction, wherein each bar section of the plurality of bar sections includes a plurality of bars that are adjacent to one another, and wherein the first subset of bars includes at least two bars;

grinding and slicing a first subset of bars of a bar section, the first subset of bars including at least two bars;

obtaining magnetic erase width (MEW) of the first subset of bars, and determining an air bearing surface (ABS) tilt angle for a second subset of bars of the bar section based on the (MEW); and

grinding and slicing a second subset of bars of the bar section based on the ABS tilt angle such that the first and second subsets of bars have different ABS tilt angles.

10. The method of claim 9, further comprising performing a first lapping process subsequent to the grinding and slicing of the first subset of bars.

11. The method of claim 10, further comprising performing a second lapping process subsequent to the grinding and slicing of the second subset of bars.

12. The method of claim 11, further comprising performing first and second slider fabrication and head gimbal assembly (HGA) processing subsequent to the grinding and slicing of the first subset of bars and the grinding and slicing of the second subset of bars, respectively, to obtain the MEW of the first subset of bars.

13. The method of claim 11, further comprising:

grinding and slicing additional first subsets of bars for additional bar sections;

obtaining additional MEWs of the additional first subsets of bars, and determining additional ABS tilt angles for additional second subsets of bars for the additional bar sections based on the additional MEWs of the additional first subsets of bars; and

grinding and slicing the second subsets of bars of the additional bar section based on the additional ABS tilt angles determined for each of the additional bar sections.

14. The method of claim 13, wherein dividing the wafer into bar sections comprises sorting the bar sections into a top bar section, a bottom bar section, edge bar sections, and middle bar sections.

15. The method of claim 14, wherein the additional ABS tilt angles comprises a plurality of ABS tilt angles determined for bars of the top bar section, bars of the bottom bar section, bars of the edge bar sections, and bars of the middle bar sections.

16. The method of claim 13, wherein the first subset of bars comprise a top bar, a middle bar, and a bottom bar extracted from one of the top bar section, the bottom bar section, the edge bar sections, and the middle bar sections.

17. The method of claim 13, wherein the additional first subsets of bars comprise respective top bars, middle bars, and bottom bars extracted from respective ones of the top bar section, the bottom bar section, the edge bar sections, and the middle bar sections.

18. The method of claim 9, wherein the ABS tilt angle of the second subset of bars comprises a 90 degree angle having a variance up to +/- 0.5 degrees.

19. The method of claim 9, wherein the magnetic device comprises a magnetic read head.