Description

This invention relates to a magnetoresistive read transducer assembly for reading data from a magnetic record medium.

Magnetoresistive (MR) sensors or heads are known which are capable of reading data from a magnetic surface at great linear densities. An MR sensor detects magnetic field signals through the resistance changes of a read element made from a magnetoresistive material as a function of the amount and direction of magnetic flux being sensed by the element.

It is also known that in order for an MR element to operate optimally, two bias fields should be provided. In order to bias the material so that its response to a flux field is linear a transverse bias field is generally provided. This bias field is normal to the plane of the magnetic media and parallel to the surface of the planar MR element.

The other bias field which is usually employed with MR elements is referred to in the art as the longitudinal bias field which extends parallel to the surface of the magnetic media and parallel to the length of the MR element. The function of the longitudinal bias field is to suppress Barkhausen noise which originates from multi-domain activities in the MR element.

Numerous prior art biasing methods and apparatus for MR sensors have been developed which use both longitudinal and transverse bias together, and these prior art biasing methods and apparatus have been effective to meet prior art requirements. However, the drive towards increased recording density has led to the requirement for narrower recording tracks and increased linear recording density along the tracks. The small MR sensors which are necessary to meet these requirements cannot be made with the use of the prior art techniques due to competing bias requirements. On the one hand, the longitudinal bias must be strong enough for domain suppression and this bias produces a field along the MR element. On the other hand, the transverse bias field is normal to the longitudinal bias field, so the longitudinal bias field competes against the transverse bias field and the transverse data signal. As a result of this bias competition, the MR sensor is chronically under-biased and signal sensitivity is significantly reduced. These high recording density applications require a very efficient output which prior art techniques are unable to produce.

US-A-3 887 944 discloses an integrated array of side-by-side MR reading heads. To eliminate crosstalk between adjacent MR read heads, a region of high coercivity material is formed between adjacent MR sensors. One of the ways discussed to produce the region of high coercivity material is by exchange coupling between an antiferromagnetic material and the MR sensor. However, there is no consideration of the possibility of obtaining exchange bias fields from this coupling, the direction of such bias fields, if they do exist, and the subsequent domain states of the MR sensor.

US-A-4 103 315 discloses a magnetoresistive read transducer assembly having the precharacterising features of the main claim appended hereto. It describes the use of antiferromagnetic-ferromagnetic exchange coupling to produce a uniform longitudinal bias along the entire MR sensor for domain suppression.

According to the invention, there is provided a magnetoresistive read transducer assembly comprising:

a thin film magnetoresistive layer;

first biasing means for producing a longitudinal bias in the magnetoresistive layer, the longitudinal bias being of a level sufficient to maintain the magnetoresistive layer in a single domain state,

second biasing means for producing a transverse bias in at least a part of the central region between two end regions of said magnetoresistive layer, the transverse bias being of a level sufficient to maintain said part of the central region of the magnetoresistive layer in a linear response mode; and

conductive means connected to said magnetoresistive layer within said central region to define a detection region so that resistance changes in the detection region produced by magnetic fields which are intercepted by the magnetoresistive layer can be detected;

the assembly being characterised by the first biasing means being such as to produce said longitudinal bias in only said two end regions of the magnetoresistive layer.

How the invention can be carried out will now be described by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a diagram showing conceptually how the longitudinal bias is non-uniformly applied to the MR layer according to the present invention;

Figure 2 is a diagram showing the aligned state of the longitudinal bias field;

Figure 3 is a diagram showing the relationship of various regions of an MR layer according to the present invention;

Figure 4 is an end view of a specific embodiment of a MR read transducer assembly embodying the invention;

Figure 5 is a plan view of the transducer shown in Figure 4;

Figure 6 is a section view on line 6-6 of Figure 4.

The principles of operation of a magnetoresistive (MR) sensor, according to the invention, will be described with reference to Figures 1-3.

A magnetoresistive (MR) sensor 10 (Figure 1) is provided with longitudinal as well as transverse bias, and the resulting bias is such as to render the sensor with excellent sensitivity and side reading characteristics. However, the bias is not uniformly applied to the MR sensor. The longitudinal bias (H_{BL}) for domain suppression is applied only to the end regions 12 of the MR sensor 10, and the transverse bias (H_{TB}) for a linear response mode is applied to at least a part of the central region 14 of the MR sensor 10.

The longitudinal bias can be produced by any suitable method known in the art for producing a longitudinal bias. In the preferred embodiment, the longitudinal bias is produced by an exchange biasing method. The exchange bias is produced by patterning an antiferromagnetic layer 16 so that it covers only the end regions 12 of the MR sensor 10, and, as a result, only the end regions 12 of the MR sensor 10 are exchange biased. The antiferromagnetic layer 16 creates an interfacial exchange interaction in the hatched areas 16a in Figure 1 that results in an effective bias field experienced by the MR sensor 10, and this bias field is oriented longitudinally for domain suppression.

The effects of the longitudinal biasing are indicated in Figure 2. The end regions 12 of the MR sensor 10 are maintained in a single domain state by the longitudinal bias with the bias field oriented along the MR sensor in the same direction, to the right as shown in Figure 2. However, the central region 14 of the MR sensor 10 experiences no direct field from the longitudinal bias, H_{BL}, and for this reason no significant loss of transverse sensitivity of MR sensor 10 occurs. The aligned single domain magnetic state at the end regions 12 of MR sensor 10 renders reverse domain creation in the central region 14 very unfavourable, thereby inducing a single domain state in the central region 14 of the MR sensor 10 as shown in Figure 2.

Once the longitudinal bias, H_{BL}, has been produced, at least a part of the central region 14 of MR sensor 10 is provided with a transverse bias of a level sufficient to maintain that part of central region 14 of the MR sensor 10 in a linear response mode. The transverse bias can be provided by shunt biasing, soft-film biasing, or permanent magnet biasing as is known in the art to produce a desired rotation in magnetic moment M, as shown in Figure 3. An output signal i_s can then be coupled out to a sensing means, with the aid of electrical conductor means 18,20 which are connected to the MR sensor 10 within the central region 14 of the MR sensor 10. The signal i_s enables the sensing means to determine the resistance changes in a detection region within said central region 14 as a function of the fields which are intercepted by the MR sensor 10 from previously recorded data on a magnetic medium, for example. The distance between the inner edges of conductor means 18 and 20 comprises the detection region over which the output signal is sensed.

The simplest configuration is an unshielded MR sensor. In this case, since the signal flux from recorded magnetic transitions can enter the sensor through its entire height, linear recording density is usually low. The recording density is limited primarily by practical lower limits to the height of the sensor. To improve the linear recording density, the MR element is usually placed in the gap between two soft-magnetic shields.

The signal performance of an MR sensor embodying the present invention is minimally affected by variations in the level of longitudinal bias so long as the level of longitudinal bias is sufficient to maintain the end regions 14 of the MR sensor 10 in a single domain state. In direct contrast, the competing bias requirements of prior art MR sensors cause a significant effect on the signal performance of the MR sensor due to changes in the level of longitudinal bias.

The present invention is based on the premise that with the end regions in a single domain mode, the central region is forced into a single domain mode and this is true so long as the longitudinally unbiased gap (L_{NLB}) is not too large in comparison to the height of the MR sensor.

The relationship between the longitudinally unbiased length, L_{NLB}, the transverse biased length, L_{TB}, and the length of the detection region, L_D, is shown in Figure 3. The relationship between these lengths is such that

$L_{NLB} \rightarrow L_{TB} \rightarrow L_D$ is generally true

also,

$L_{TB} \rightarrow L_D$ and $L_{NTB} \rightarrow L_D$ holds true.

While it is true that generally there is no overlap of L_{NLB} and L_{TB}, some overlap is permissible so long as the above conditions relative to L_D are met.

When the additional constraint of side reading suppression is considered, it is clear that L_{TB} should not be greater than L_D since L_D is normally chosen substantially equal to the recording track width and the existence of an area of transverse biased sensor outside the detection region L_D would result in increased side reading from adjacent tracks. Also, it is clear that L_{NLB} should not be greater than L_D since the end regions, due to the strong longitudinal bias, are made insensitive to signals from neighbouring tracks. As a result, side-reading would be suppressed. These considerations lead to the conclusion that $L_{NLB} = L_{TB} = L_D$ is the optimum arrangement for maximum sensitivity and also greatest side reading suppression.

A specific embodiment of a MR read transducer assembly embodying the invention is represented in Figures 4, 5 and 6. Referring to Figure 4, a MR thin film layer 10 is in intimate electrical contact with an antiferromagnetic thin film layer 16. The thin film layers 10 and 16 produce exchange bias in the covered area of the MR layer 10 so that it is longitudinally biased in a single domain mode in the end regions 12. On the opposite side of MR layer 10, there is a means for producing a transverse bias field comprising a soft magnetic film layer 22, the layer 22 being separated from the MR layer 10 by a thin spacer layer 24. The purpose of layer 22 is to provide a soft film transverse bias of the central region 14 of the MR layer 10. Magnetic shields 26 and 28 are provided to minimise the effects of stray magnetic flux which would decrease the resolution of the readback signal, and electrical insulating layers 30 and 32 are provided to isolate these shields from the active components of the transducer assembly.

The choice of materials for the MR layer 10 and the antiferromagnetic layer 16 in Figure 4 is a significant consideration. For the MR layer 10, a soft magnetic material is desired which has low magnetostriction and a reasonably high MR coefficient. In

general, a very thin film would be desirable since thinner films are more sensitive. However, as a practical matter, the thickness of the film must be chosen to avoid very thin films whose thickness and properties are hard to control. The MR layer 10 may be formed reliably if it has a thickness in the range of approximately 20 to 50 nm. In a specific embodiment, Permalloy NiFe alloy was used.

Layer 16 must be of a material that is antiferromagnetic not only when deposited over the material chosen for the MR layer but also when deposited in a thin film form. In addition, the material should have a Neel temperature substantially higher than the operating temperature of the read transducer. The antiferromagnetic layer 16 is deposited to produce a unidirectional bias along the length of the assembly. Alternatively, the direction of the unidirectional bias field can be set by heating the MR-antiferromagnetic material layer above the ordering temperature, and then cooling the layer in an externally applied unidirectional magnetic field. The material should be thick enough for reliable fabrication with a minimum thickness of about 10 nm, and ranging up to several tens nm. In a specific embodiment MnFe was used.

The soft film material of layer 22 in Figure 4 must exhibit high permeability, high resistivity, and no appreciable MR effect of its own. The high permeability ensures adequate biasing from bias source 21 with modest bias currents, the high resistivity is desirable to minimise electrical shunting of signal, and the low MR coefficient compared with that of the MR layer 10 is needed to avoid cancellation of biasing and signal responses. The thickness of the soft-film biasing layer 22, usually in a range of 10 to 50 nm, is chosen so that it will saturate. The characteristics of the material being used for the MR layer 10 must also be considered so that the ratio of thicknesses of the MR layer 10 and the soft film bias layer 22 can be chosen to produce the transverse bias to bias the central region 14 of MR layer 10 to the chosen angle. In a specific embodiment, NiFeRh was used for layer 22.

The purpose of spacer layer 24 is to provide physical spacing between the MR layer 10 and soft film bias layer 22, since separation is necessary for these layers to produce opposite magnetisation rotations. Spacer layer 24 should have high resistivity, should not diffuse into either of the layers 10 and 22, and should have the property of being easily deposited in thin layers. The layer 24 should be as thin as can be reliably fabricated such as 20 nm, for example. In a specific embodiment, Ta was used for this layer, but other materials such as Al_2O_3 or SiO_2 could also be used.

A magnetoresistive read transducer embodying the invention can be made by any of the known thin film manufacturing processes in a manner similar to making integrated circuit chips. These manufacturing processes include the deposition of the thin film layers on a substrate, and appropriate shaping of the layers by suitable techniques such as selective etching and photolithographic techniques.

Claims

1. A magnetoresistive read transducer assembly comprising:
a thin film magnetoresistive layer (10);
first biasing means (16) for producing a longitudinal bias in the magnetoresistive layer, the longitudinal bias being of a level sufficient to maintain the magnetoresistive layer in a single domain state;
second biasing means (18, 20, 21) for producing a transverse bias in at least a part of the central region (14) between two end regions (12) of said magnetoresistive layer, the transverse bias being of a level sufficient to maintain said part of the central region of the magnetoresistive layer in a linear response mode; and
conductive means (18, 20) connected to said magnetoresistive layer within said central region to define a detection region so that resistance changes in the detection region produced by magnetic fields which are intercepted by the magnetoresistive layer can be detected;
the assembly being characterised by the first biasing means (16) being such as to produce said longitudinal bias in only said two end regions (12) of the magnetoresistive layer.

2. A magnetoresistive read transducer assembly as claimed in claim 1, wherein said magnetoresistive layer is composed of NiFe.

3. A magnetoresistive read transducer assembly as claimed in claim 1 or claim 2, wherein said magnetoresistive layer has a thickness in the range of 20 to 50 nm.

4. A magnetoresistive read transducer assembly as claimed in any preceding claim, in which the first biasing means comprises a thin film of antiferromagnetic material in direct contact with only said end regions of said magnetoresistive layer to produce said longitudinal bias by exchange biasing.

5. A magnetoresistive read transducer assembly as claimed in claim 4, wherein said thin film of antiferromagnetic material is composed of MnFe.

6. A magnetoresistive read transducer assembly as claimed in claim 4 or claim 5, wherein said thin film of antiferromagnetic material has a thickness in the range of 10 to 50 nm.

7. A magnetoresistive read transducer assembly as claimed in any preceding claim, wherein said conductive means comprises spaced conductive elements, and said detection region is defined by the inner edges of said conductive elements.

8. A magnetoresistive read transducer assembly as claimed in any preceding claim, wherein the central region of said magnetoresistive layer which is not longitudinally biased, said detection region, and said at least a part of said central region in which a transverse bias is produced, are of substantially the same size.

9. A magnetoresistive read transducer assembly as claimed in any preceding claim, further comprising:
a thin film of soft magnetic material disposed parallel to but spaced from the magnetoresistive layer; and
means for supplying a bias current to said conductive means to magnetically bias said magnetoresis-

general, a very thin film would be desirable since thinner films are more sensitive. However, as a practical matter, the thickness of the film must be chosen to avoid very thin films whose thickness and properties are hard to control. The MR layer 10 may be formed reliably if it has a thickness in the range of approximately 20 to 50 nm. In a specific embodiment, Permalloy NiFe alloy was used.

Layer 16 must be of a material that is antiferromagnetic not only when deposited over the material chosen for the MR layer but also when deposited in a thin film form. In addition, the material should have a Neel temperature substantially higher than the operating temperature of the read transducer. The antiferromagnetic layer 16 is deposited to produce a unidirectional bias along the length of the assembly. Alternatively, the direction of the unidirectional bias field can be set by heating the MR-antiferromagnetic material layer above the ordering temperature, and then cooling the layer in an externally applied unidirectional magnetic field. The material should be thick enough for reliable fabrication with a minimum thickness of about 10 nm, and ranging up to several tens nm. In a specific embodiment MnFe was used.

The soft film material of layer 22 in Figure 4 must exhibit high permeability, high resistivity, and no appreciable MR effect of its own. The high permeability ensures adequate biasing from bias source 21 with modest bias currents, the high resistivity is desirable to minimise electrical shunting of signal, and the low MR coefficient compared with that of the MR layer 10 is needed to avoid cancellation of biasing and signal responses. The thickness of the soft-film biasing layer 22, usually in a range of 10 to 50 nm, is chosen so that it will saturate. The characteristics of the material being used for the MR layer 10 must also be considered so that the ratio of thicknesses of the MR layer 10 and the soft film bias layer 22 can be chosen to produce the transverse bias to bias the central region 14 of MR layer 10 to the chosen angle. In a specific embodiment, NiFeRh was used for layer 22.

The purpose of spacer layer 24 is to provide physical spacing between the MR layer 10 and soft film bias layer 22, since separation is necessary for these layers to produce opposite magnetisation rotations. Spacer layer 24 should have high resistivity, should not diffuse into either of the layers 10 and 22, and should have the property of being easily deposited in thin layers. The layer 24 should be as thin as can be reliably fabricated such as 20 nm, for example. In a specific embodiment, Ta was used for this layer, but other materials such as Al_2O_3 or SiO_2 could also be used.

A magnetoresistive read transducer embodying the invention can be made by any of the known thin film manufacturing processes in a manner similar to making integrated circuit chips. These manufacturing processes include the deposition of the thin film layers on a substrate, and appropriate shaping of the layers by suitable techniques such as selective etching and photolithographic techniques.

Claims

1. A magnetoresistive read transducer assembly comprising:
a thin film magnetoresistive layer (10);
first biasing means (16) for producing a longitudinal bias in the magnetoresistive layer, the longitudinal bias being of a level sufficient to maintain the magnetoresistive layer in a single domain state;
second biasing means (18, 20, 21) for producing a transverse bias in at least a part of the central region (14) between two end regions (12) of said magnetoresistive layer, the transverse bias being of a level sufficient to maintain said part of the central region of the magnetoresistive layer in a linear response mode; and
conductive means (18, 20) connected to said magnetoresistive layer within said central region to define a detection region so that resistance changes in the detection region produced by magnetic fields which are intercepted by the magnetoresistive layer can be detected;
the assembly being characterised by the first biasing means (16) being such as to produce said longitudinal bias in only said two end regions (12) of the magnetoresistive layer.

2. A magnetoresistive read transducer assembly as claimed in claim 1, wherein said magnetoresistive layer is composed of NiFe.

3. A magnetoresistive read transducer assembly as claimed in claim 1 or claim 2, wherein said magnetoresistive layer has a thickness in the range of 20 to 50 nm.

4. A magnetoresistive read transducer assembly as claimed in any preceding claim, in which the first biasing means comprises a thin film of antiferromagnetic material in direct contact with only said end regions of said magnetoresistive layer to produce said longitudinal bias by exchange biasing.

5. A magnetoresistive read transducer assembly as claimed in claim 4, wherein said thin film of antiferromagnetic material is composed of MnFe.

6. A magnetoresistive read transducer assembly as claimed in claim 4 or claim 5, wherein said thin film of antiferromagnetic material has a thickness in the range of 10 to 50 nm.

7. A magnetoresistive read transducer assembly as claimed in any preceding claim, wherein said conductive means comprises spaced conductive elements, and said detection region is defined by the inner edges of said conductive elements.

8. A magnetoresistive read transducer assembly as claimed in any preceding claim, wherein the central region of said magnetoresistive layer which is not longitudinally biased, said detection region, and said at least a part of said central region in which a transverse bias is produced, are of substantially the same size.

9. A magnetoresistive read transducer assembly as claimed in any preceding claim, further comprising:
a thin film of soft magnetic material disposed parallel to but spaced from the magnetoresistive layer; and
means for supplying a bias current to said conductive means to magnetically bias said magnetoresis-

* C L M S *

tive layer with transverse bias of a level sufficient to maintain said magnetoresistive layer in a high sensitivity condition whereby signal sensing means connected to said conductive means can determine the resistance changes in said magnetoresistive layer as a function of the fields which are intercepted thereby.

10. A magnetoresistive read transducer assembly as claimed in claim 9 wherein said thin film of soft magnetic material is composed of NiFeRh.

11. A magnetoresistive read transducer assembly as claimed in Claim 9 or Claim 10, wherein said thin film of soft magnetic material is thinner than said magnetoresistive layer.

12. A magnetoresistive read transducer assembly as claimed in any preceding claim, disposed between magnetic shields.

Patentansprüche

1. Magnetresistente Leseumformermontage, enthaltend:
eine dünne magnetresistente Schicht (10);
erste Vorspannungsmittel (16) für die Erzeugung einer Längsspannung in der magnetresistenten Schicht, wobei die Längsspannung ausreicht, um die magnetresistente Schicht in einem Zustand mit nur einem Bereich zu halten;
zweite Vorspannungsmittel (18, 20, 21) für die Erzeugung einer Vorspannung in Querrichtung in mindestens einem Teil der mittleren Zone (14) zwischen zwei Endzonen (12) der besagten magnetresistenten Schicht, wobei die besagte Querspannung ausreicht, um den besagten Teil der mittleren Zone der magnetresistenten Schicht in einem Zustand mit linearer Antwort zu halten; und
Leitmittel (18, 20), an besagte magnetresistente Schicht innerhalb der besagten mittleren Zone angeschlossen, um eine Detektionsregion zu definieren, so daß Widerstandsänderungen in der Detektionsregion, die von magnetischen Feldern erzeugt werden, welche durch die magnetresistente Schicht abgefangen werden, detektiert werden können;
Montage durch die ersten Vorspannmittel (16) gekennzeichnet, die so bemessen sind, daß die besagte Längsvorspannung nur in den besagten zwei Endzonen (12) der magnetresistenten Schicht erzeugt wird.

2. Magnetresistente Leseumformermontage gemäß Anspruch 1, in der die besagte magnetresistente Schicht aus NiFe besteht.

3. Magnetresistente Leseumformermontage gemäß Anspruch 1, oder Anspruch 2, worin besagte magnetresistente Schicht eine Dicke im Bereich von 20 bis 50 nm aufweist.

4. Magnetresistente Leseumformermontage, gemäß einem der vorangehenden Ansprüche, in der das erste Vorspannungsmittel enthält: einen dünnen Film antiferromagnetischen Materials in direktem Kontakt mit nur den besagten Endzonen der besagten magnetresistenten Schicht, um besagte Vorspannung in Längsrichtung durch Vorspannungsaustausch zu erzeugen.

5. Magnetresistente Leseumformermontage gemäß Anspruch 4, in der der besagte dünne Film eines antiferromagnetischen Materials aus MnFe besteht.

6. Magnetresistente Leseumformermontage gemäß Anspruch 4 oder Anspruch 5, in der der besagte dünne Film antiferromagnetischen Materials eine Dicke im Bereich von 10 bis 50 nm aufweist.

7. Magnetresistente Leseumformermontage, gemäß einem der vorangehenden Ansprüche, in der das besagte Leitmittel in Abständen angeordnete Leitelemente enthält, und die besagte Detektionszone durch die Innenränder der besagten Leitelemente bestimmt wird.

8. Magnetresistente Leseumformermontage gemäß einem der vorangehenden Ansprüche, in der die zentrale Zone der besagten magnetresistenten Schicht ohne Vorspannung in Längsrichtung, die besagte Detektionszone und mindestens ein Teil der besagten mittleren Zone, in der eine Vorspannung in Querrichtung erzeugt wird, im wesentlichen von der selben Größe sind.

9. Magnetresistente Leseumformermontage gemäß einem der vorangehenden Ansprüche, ferner enthaltend:
einen dünnen Film weichen magnetischen Materials, parallel zur magnetresistenten Schicht angeordnet, aber in einem Abstand von ihr; und
Mittel für die Bereitstellung eines Vorspannungsstroms an besagte leitfähige Mittel, um an besagte magnetresistente Schicht eine Vorspannung in Querrichtung mit ausreichender Höhe anzulegen, um besagte magnetresistente Schicht in einem Zustand hoher Empfindlichkeit zu halten, wodurch auf Signale ansprechende Mittel, die an die Leitmittel angeschlossen sind, die Widerstandsänderungen in besagter magnetresistenter Schicht als eine Funktion der Felder, die dadurch abgefangen werden, bestimmen können.

10. Magnetresistente Leseumformermontage gemäß Anspruch 9, in der besagter dünner Film magnetischen Materials aus NiFeRh besteht.

11. Magnetresistente Leseumformermontage gemäß Anspruch 9 oder Anspruch 10, in der besagter dünner Film weichen magnetischen Materials dünner ist als besagte magnetresistente Schicht.

12. Magnetresistente Leseumformermontage gemäß einem der vorangehenden Ansprüche, zwischen magnetischen Abschirmungen angeordnet.

Revendications

1. Un bloc transducteur de lecture magnétorésistif, comprenant :
- une couche magnétorésistive en film mince (10),
- des premiers moyens de polarisation (16), pour produire une polarisation longitudinale dans la couche magnétorésistive, la polarisation longitudinale étant d'un niveau suffisant pour maintenir la couche magnétorésistive dans un seul et même état de domaine,
- des seconds moyens de polarisation (18, 20, 21), pour produire une polarisation transversale au moins dans une partie de la région centrale (14) située entre deux régions d'extrémité (12) de ladite couche magnétorésistive, la polarisation transversale étant d'un niveau suffisant pour conser-

* C L M S *

ver un mode de réponse linéaire pour cette partie de la région centrale de la couche magnétorésistive, et

- des moyens conducteurs (18, 20), reliés à la couche magnétorésistive dans ladite région centrale, pour définir une région de détection telle que l'on puisse détecter les variations de résistance dans la région de détection produites par les champs magnétiques interceptés par la couche magnétorésistive,

ce bloc étant caractérisé en ce que les premiers moyens de polarisation (16) sont tels qu'ils ne produisent ladite polarisation longitudinale que dans lesdites régions d'extrémité (12) de la couche magnétorésistive.

2. Le bloc transducteur de lecture magnétorésistif de la revendication 1, dans lequel la couche magnétorésistive est composée de NiFe.

3. Le bloc transducteur de lecture magnétorésistif de la revendication 1 ou de la revendication 2, dans lequel la couche magnétorésistive a une épaisseur comprise entre 20 et 50 nm.

4. Le bloc transducteur de lecture magnétorésistif de l'une des revendications précédentes, dans lequel les premier moyens de polarisation comprennent un film mince de matériau antiferromagnétique en contact direct avec les régions d'extrémité de la couche magnétorésistive et elles seules, afin de produire la polarisation longitudinale par polarisation permutée.

5. Le bloc transducteur de lecture magnétorésistif de la revendication 4, dans lequel le film mince de matériau antiferromagnétique est composé de MnFe.

6. Le bloc transducteur de lecture magnétorésistif de la revendication 4 ou de la revendication 5, dans lequel le film mince de matériau antiferromagnétique a une épaisseur comprise entre 10 et 50 nm.

7. Le bloc transducteur de lecture magnétorésistif de l'une des revendications précédentes, dans lequel lesdits moyens conducteurs comprennent des éléments conducteurs placés à distance l'un de l'autre, ladite région de détection étant définie par les bords intérieurs de ces éléments conducteurs.

8. Le bloc transducteur de lecture magnétorésistif de l'une des revendications précédentes, dans lequel la région centrale de la couche magnétorésistive qui n'est pas polarisée longitudinalement, ladite région de détection et la partie au moins de la région centrale dans laquelle on produit une polarisation transversale sont pratiquement de même dimension.

9. Le bloc transducteur de lecture magnétorésistif de l'une des revendications précédentes, comprenant en outre :

- un film mince de matériau magnétique doux, disposé parallèlement à la couche magnétorésistive mais à distance de celle-ci, et
- des moyens pour appliquer un courant de polarisation aux moyens conducteurs afin de polariser magnétiquement la couche magnétorésistive par une polarisation transversale d'un niveau suffisant pour maintenir cette couche magnétorésistive dans un état de sensibilité élevé, de sorte que les moyens de détection du signal reliés à ces moyens conducteurs puissent déterminer les variations de résistance dans la couche magnétorésistive en fonction des champs qui y sont interceptés.

10. Le bloc transducteur de lecture magnétorésistif de la revendication 9, dans lequel le film mince de matériau magnétique doux est composé de NiFeRh.

11. Le bloc transducteur de lecture magnétorésistif de la revendication 9 ou de la revendication 10, dans lequel le film mince de matériau magnétique doux est plus mince que la couche magnétorésistive.

12. Le bloc transducteur de lecture magnétorésistif de l'une des revendications précédentes, disposé entre des écrans magnétiques.

* C L M S *