Example 7

[0078] **FIG. 20** shows a representative structure of an already known MRAM as one example of the magnetic recording sensor. The magnetic recording sensor has a structure comprising a plurality of cells in parallel including a magnetoresistive sensor layer **2002** for recording information, a bit line **2001** connected to the magnetoresistive sensor layer for flowing an electric current to the sensor, a word line **2005** in the position opposite the bit line **2001** by interposing therebetween the magnetoresistive sensor layer **2002** and in the position away from the magnetoresistive sensor layer **2002** for performing recording operation onto the magnetoresistive sensor layer orthogonally to the bit line, an amplifying system for amplifying a read signal, and a read conductive line **2007** for switching between read and write, wherein the magnetoresistive sensor layer **2002** comprises the magnetoresistive sensor layer as shown in Example 1. Since an electric current flows perpendicular to the plane, the use of the magnetoresistive sensor layer is similar to that of Example 1. The magnetoresistive sensor layer has the size consisting of one side of 0.2 to 0.25 μm. The magnetization of the free layer of the magnetoresistive sensor layer is rotated in the direction of an electric current flowing through the word line and the bit line, by varying the direction of the synthetic magnetic field caused in the magnetoresistive sensor layer portion. When the magnetization direction of the free layer of the magnetoresistive sensor layer is rotated and the magnetic domain is caused in the free layer, the resistance value to the magnetic field is varied to lower the S/N ratio, so that memory cannot be read. In order to controllably perform this, the magnetic domain control layer is required. Magnetic domain control layers having high electric resistivity **2008** devised in the present invention are positioned on opposite ends of the magnetoresistive element layer **2002**. Thus, magnetic domain control is possible without loss of shunting to the magnetic domain control layer, so as to improve the recording density of the magnetic recording sensor.

[0079] According to the present invention, in the magnetoresistive sensor using the magnetoresistive sensor layer, (1) a loss of shunting to the magnetic domain control layer can be eliminated, (2) the number of conventional processes for manufacturing the magnetic domain control layer can be reduced, and (3) magnetic domain control can be conducted finely by making the gap between the shields smaller since the thickness of the magnetic domain control layer can be reduced by the size of the pressure-resistant protective layer. Accordingly, (4) the magnetoresistive sensor flowing an electric current perpendicular to the plane can provide the magnetic domain control layer practicable. Further, the magnetoresistive sensor of the present invention is used to provide the magnetic head having excellent reproducing resolution and the magnetic disk apparatus.

What is claimed is:

1. A magnetoresistive sensor including a substrate, a pair of magnetic shield layers consisting of a lower magnetic shield layer and an upper magnetic shield layer, a magnetoresistive sensor layer disposed between the pair of magnetic shields, an electrode terminal for flowing a signal current perpendicular to the plane of the magnetoresistive sensor layer, and magnetic domain control layers for controlling Barkhausen noise of said magnetoresistive sensor layer, wherein said magnetic domain control layers disposed on opposite ends of the magnetoresistive sensor layer in a region from the end surface of a media-opposed surface side of the magnetoresistive sensor layer to the depth position are made of a material having a specific resistance not less than 10 mΩcm, and are in contact with at least opposite end surfaces of said magnetoresistive sensor layer in said region.

2. The magnetoresistive sensor according to claim 1, comprising magnetic yoke layers disposed between the pair of magnetic shields, having a shape extended from the position exposed from the media-opposed surface in the depth direction, and guiding the magnetic field of the recording media to its interior, wherein said magnetoresistive sensor layer is disposed between the magnetic yoke layers in the position recessed from the media-opposed surface, said magnetic domain control layers are provided on opposite ends of the magnetoresistive sensor layer in a region from the end surface of the media-opposed surface side of the magnetoresistive sensor layer and the magnetic yoke layer to the depth position and are in contact with at least opposite end surfaces of said magnetoresistive sensor layer in said region, and the magnetic domain control layers are in contact with opposite end surfaces of said magnetic yoke layer in at least one portion of the region from the end surface of the media-opposed surface side of said magnetic yoke layer to the depth position.

3. The magnetoresistive sensor according to claim 1, comprising a flux guide type magnetic yoke layer disposed between the pair of magnetic shields, having a shape extended from the position exposed from the media-opposed surface in the depth position, and being in contact with any one of the magnetic shield layers to guide the magnetic flux of the media, and magnetic domain control layers for controlling Barkhausen noise of the magnetoresistive sensor layer and the flux guide type magnetic yoke layer, wherein said magnetoresistive sensor layer is disposed at the upper or lower side of said flux guide type yoke layer in the position recessed from the media-opposed surface, the flux guide type yoke layer has an discontinuous portion in a region in contact with said magnetoresistive sensor layer, said magnetic domain control layers disposed on opposite ends of the magnetoresistive sensor layer in the region from the end surface of the media-opposed surface side of said magnetoresistive sensor layer and said flux guide type magnetic yoke layer to the depth position are in contact with at least opposite end surfaces of said magnetoresistive sensor layer in the region from the end surface of the media-opposed surface side of said magnetoresistive sensor layer to the depth position, and the magnetic domain control layers are in contact with opposite end surfaces of said magnetic yoke layer in at least one portion of the region from the end surface of media-opposed surface side of said magnetic yoke layer to the depth position.

4. The magnetoresistive sensor according to claim 1, wherein said magnetic domain control layer is made of an underlayer made of an oxide having a thickness not more than 5 nm, and an oxide material having high electric resistivity not less than 10 mΩcm formed on the oxide underlayer.

5. The magnetoresistive sensor according to claim 2, wherein said magnetic domain control layer is made of an underlayer made of an oxide having a thickness not more than 5 nm, and an oxide material having high electric resistivity not less than 10 mΩcm formed on the oxide underlayer.