CLAIMS

1. A method of manufacturing a vertical magnetic recording disk comprising at least a magnetic recording layer on a substrate and used for vertical magnetic recording at a density greater than 100 Gb/in^2, said method comprising:

a step of providing a substrate; and

~~wherein in~~ a step of forming, on the substrate, the magnetic recording layer ~~composed of~~, said forming step further comprising (a) forming a ferromagnetic layer having a granular structure and (b) forming an exchange energy control layer ~~formed~~ on the ferromagnetic layer,

wherein at least the exchange energy control layer is formed through sputtering in an atmosphere of a rare gas having a greater mass than an argon gas, said sputtering being conducted at a gas pressure in a range of 1-10 mTorr and producing said energy control layer having a thickness of 2-5 nm,

wherein the exchange energy control layer is a laminated layer composed of a first layer containing Co or a Co-alloy and a second layer containing palladium (Pd) or platinum (Pt) with said rare gas embedded therein,

whereby the surface roughness of the disk having an exchange energy control layer that is formed through sputtering in an atmosphere of a rare gas having a greater mass than an argon gas, as determined by Ra and Rmax as measured by AFM, is less than that where an exchange energy control layer is formed through sputtering in an atmosphere of argon, and

whereby the coercive force (Hc) of the resulting structure is equal to or greater than 4300 Oe.

2. The method according to claim 1, wherein the rare gas having a greater mass than the argon gas is a krypton (Kr) gas.

~~3. The method according to claim 1 or 2, wherein the exchange energy control layer is a laminated layer composed of a first layer containing Co or a Co-alloy and a second layer containing palladium (Pd) or platinum (Pt).~~

43. The method according to ~~any one of claims 1 to 3~~ claim 1 or 2, wherein the ferromagnetic layer has a crystal grain containing cobalt (Co) as a main constituent and a grain boundary portion containing an oxide, silicon (Si) or a silicon (Si) oxide as a main constituent.

54. The method according to any one of claims 1 to 43, wherein a spacer layer is formed between the ferromagnetic layer and the exchange energy control layer.

~~6. A magnetic disk for use in vertical magnetic recording, comprising:~~

~~a substrate;~~

~~a ferromagnetic layer formed on the substrate and having a granular structure and containing an oxide, silicon (Si) or a silicon (Si) oxide; and~~

~~an exchange energy control layer formed on the ferromagnetic layer, wherein the exchange energy control layer includes a laminated layer composed of a first layer containing cobalt (Co) or a Co-alloy and a second layer containing palladium (Pd) or platinum (Pt), or the exchange energy control layer includes a single layer containing the Co-alloy, and wherein the exchange energy control layer contains a krypton (Kr) element.~~

5. The method according to any one of claims 1 to 4, wherein Rmax is 6nm or less and Ra is 0.6nm or less.

6. The method according to claim 4, wherein the spacer layer is formed in in said atmosphere of a rare gas having a greater mass than an argon gas at a thickness of the spacer layer within a range of 0.1 nm to 2.0 nm.

7. The method according to any one of claims 1 to 6, wherein the ferromagnetic layer also is produced in said atmosphere of a rare gas having a greater mass than argon gas.

8. The method according to any one of claims 1 to 7, wherein the sputtering is conducted at a gas pressure in a range of 3-4 mTorr.

9. The method according to any one of claims 1 to 8, wherein the magnetization reversal nucleation field (Hn) of the disk is -1300 Oe or smaller