CLAIMS

What is claimed is:

1. A method for forming a data memory chip, comprising: providing a substrate:
depositing a first magnetic memory element type material;
forming a mask over the first magnetic memory element type material the mask defining a first magnetic element type area;
performing a material removal process to remove portions of the first magnetic element type material that are not protected by the mask;
depositing a second magnetic element type material; and
removing the mask, after removing the mask: depositing a hard mask;
performing an annealing; forming a magnetic element defining mask configured to define magnetic elements in the first magnetic element type area and also in a second magnetic element type area; and
performing a second material removal process to remove portions of the first magnetic element type material and the second magnetic element type material that are not protected by the magnetic element defining mask.

2. The method as in claim 1, wherein the second material removal process comprises reactive ion etching (RIE).

3. The method as in claim 1, wherein the mask is a bi-layer mask that includes photoresist.

4. The method as in claim 1, wherein the substrate includes electrical circuitry.

5. The method as in claim 1, wherein the substrate includes CMOS circuitry.

6. The method as in claim 1, wherein the substrate includes CMOS circuitry that is electrically connected with each of the first and second magnetic memory element type material.

7. A method for manufacturing a data memory chip, the method comprising:
providing a substrate;
forming a first mask structure over the substrate, the mask structure having an opening configured to define a first magnetic memory type area;
depositing a first magnetic memory type material;
removing the mask, leaving first magnetic memory type material in a first memory type area;

forming a second mask, at least a portion of the second mask being formed over the first magnetic memory type material in the first memory type area;

depositing a second magnetic memory type material; and

removing the second mask, after removing the second mask: depositing a hard mask; performing an annealing;

forming a third mask structure configured to define magnetic pillars in the first magnetic memory type are and in a second magnetic memory type are; and

performing a material removal process to remove both of the first and second magnetic memory type material that are not protected by the third mask.

8. The method as in claim 7, wherein the substrate includes electrical circuitry formed therein.

9. The method as in claim 7, wherein the substrate includes CMOS circuitry formed therein.

10. The method as in claim 7, wherein the substrate includes CMOS circuitry formed therein, the CMOS circuitry having electrical connection with each of the first and second magnetic memory type materials.

11. The method as in claim 1, wherein the first magnetic memory element type material has performance characteristics matching or exceeding those of a non-volatile memory, and the second magnetic memory element type material has performance characteristics matching or exceeding those of a static random access memory.

12. The method as in claim 7, wherein the first magnetic memory type material has performance characteristics matching or exceeding those of a non-volatile memory, and the second magnetic memory type material has performance characteristics matching or exceeding those of a static random access memory.

13. The method as in claim 1, wherein the first magnetic memory element type material has a thickness that is substantially the same as a thickness of the second magnetic memory element type material.

14. The method as in claim 7, wherein the first magnetic memory type material has a thickness that is substantially the same as a thickness of the second magnetic memory type material.

15. The method as in claim 1, wherein the first magnetic memory element type material has an ion milling rate that is substantially the same as an ion milling rate of the second magnetic memory element type material.

16. The method as in claim 7, wherein the first magnetic memory type material has an ion milling rate that is substantially the same as an ion milling rate of the second magnetic memory type material.

17. The method as in claim 1, wherein the first magnetic memory element type material has a thickness and ion milling rate that are substantially the same as a thickness and ion milling rate of the second magnetic memory element type material.

18. The method as in claim 7, wherein the first magnetic memory type material has a thickness and ion milling rate that are substantially the same as a thickness and ion milling rate of the second magnetic memory type material.