CLAIMS

What is claimed is:

1. A top pinned magnetic tunnel junction (MTJ) stack comprising:

a magnetic free layer having a body centered cubic (BCC) texture;

a tunnel barrier layer having a BCC texture and located on the magnetic free layer; and

a magnetic pinned layered structure located on the tunnel barrier layer, wherein the magnetic pinned layered structure comprises, from bottom to top, a first magnetic pinned layer having a BCC texture, a crystal grain growth controlling layer, and a second magnetic pinned layer having a face centered cubic (FCC) texture or a hexagonal closed packing (HCP) texture, wherein the crystal grain growth controlling layer is composed of a metal that facilitates formation of a magnetic material having the FCC texture or the HCP texture and the metal comprises rhodium (Rh), gadolinium (Gd), holmium (Ho), tantalum (Ta), hafnium (Hf) or tungsten (W).

2. A top pinned magnetic tunnel junction (MTJ) stack comprising:

a magnetic free layer having a body centered cubic (BCC) texture;

a tunnel barrier layer having a BCC texture and located on the magnetic free layer; and

a magnetic pinned layered structure located on the tunnel barrier layer, wherein the magnetic pinned layered structure comprises, from bottom to top, a first magnetic pinned layer having a BCC texture, a crystal grain growth controlling layer, and a second magnetic pinned layer having a face centered cubic (FCC) texture or a hexagonal closed packing (HCP) texture, wherein the second magnetic pinned layer comprises a lower magnetic pinned region and an upper magnetic pinned region, wherein the lower magnetic pinned region and the upper magnetic pinned region are separated by a synthetic anti-ferromagnetic coupling layer.

3. The top pinned MTJ stack of Claim 2, wherein the crystal grain growth controlling layer is composed of a metal that facilitates formation of a magnetic material having the FCC texture or the HCP texture.

4. The top pinned MTJ stack of Claim 3, wherein the metal that facilitates formation of a magnetic material having the FCC texture or the HCP texture comprises rhodium (Rh), gadolinium (Gd), holmium (Ho), tantalum (Ta), hafnium (Hf) or tungsten (W).

5. The top pinned MTJ stack of Claim 1, wherein the crystal grain growth controlling layer has a thickness from 0.05 nm to 2 nm.

6. The top pinned MTJ stack of Claim 1, wherein the first magnetic pinned layer is composed of a cobalt-iron-boron (Co-Fe-B) alloy or a Co-Fe-B alloy multilayered stack containing additional iron.

7. The top pinned MTJ stack of Claim 6, further comprising a metal insertion layer present in the Co-Fe-B alloy multilayered stack, wherein the metal insertion layer comprises tungsten (W), tantalum (Ta), iridium (Ir) or terbium (Tb).

8. The top pinned MTJ stack of Claim 1, wherein the second magnetic pinned layer is composed of a multilayer or superlattice of cobalt (Co) and platinum (Pt), a multilayer or superlattice of cobalt (Co) and palladium (Pd) or a multilayer or superlattice of cobalt (Co), nickel (Ni) and platinum (Pt).

9. A spin-transfer torque magnetoresistive random access memory (STT MRAM) device comprising:

a top pinned magnetic tunnel junction (MTJ) stack located on a bottom electrode, wherein the top pinned MTJ stack comprises:

a magnetic free layer having a body centered cubic (BCC) texture;

a tunnel barrier layer having a BCC texture and located on the magnetic free layer; and

a magnetic pinned layered structure located on the tunnel barrier layer, wherein the magnetic pinned layered structure comprises, from bottom to top, a first magnetic pinned layer having a BCC texture, a crystal grain growth controlling layer, and a second magnetic pinned layer having a face centered cubic (FCC) texture or a hexagonal closed packing (HCP) texture, wherein the crystal grain growth controlling layer is composed of a metal that facilitates formation of a magnetic material having the FCC texture or the HCP texture, and the metal comprises rhodium (Rh), gadolinium (Gd), holmium (Ho), tantalum (Ta), hafnium (Hf) or tungsten (W).

10. The STT MRAM device of Claim 9, wherein the second magnetic pinned layer comprises a lower magnetic pinned region and an upper magnetic pinned region, wherein the lower magnetic pinned region and the upper magnetic pinned region are separated by a synthetic anti-ferromagnetic coupling layer.

11. The STT MRAM device of Claim 9, wherein the crystal grain growth controlling layer has a thickness from 0.05 nm to 2 nm.

12. The STT MRAM device of Claim 9, wherein the first magnetic pinned layer is composed of a cobalt-iron-boron (Co-Fe-B) alloy or a Co-Fe-B alloy multilayered stack containing additional iron.

13. The STT MRAM device of Claim 12, further comprising a metal insertion layer present in the Co-Fe-B alloy multilayered stack, wherein the metal insertion layer comprises tungsten (W), tantalum (Ta), iridium (Ir) or terbium (Tb).

14. The STT MRAM device of Claim 9, wherein the second magnetic pinned layer is composed of a multilayer or superlattice of cobalt (Co) and platinum (Pt), a multilayer or superlattice of

cobalt (Co) and palladium (Pd) or a multilayer or superlattice of cobalt (Co), nickel (Ni) and platinum (Pt).