CLAIMS

What is claimed is:

1. A method of etching a stack with at least one metal layer in one or more cycles with each cycle comprising:

performing an initiation step, transforming part of the at least one metal layer into metal oxide, metal halide, or lattice damaged metallic sites; and

performing a reactive step providing one or more cycles, where each cycle, comprises:

providing an organic solvent vapor to form a solvated metal, metal halide, or metal oxide state; and

providing an organic ligand solvent to form volatile organometallic compounds.

2. The method, as recited in claim 1, wherein the providing an organic solvent vapor to form a solvated metal, metal halide, or metal oxide state and providing an organic ligand solvent to form volatile organometallic compounds are performed sequentially.

3. The method, as recited in claim 1, wherein the providing an organic solvent vapor to form a solvated metal, metal halide, or metal oxide state and providing an organic ligand solvent to form volatile organometallic compounds are performed simultaneously.

4. The method, as recited in claim 1, wherein the organic solvent vapor comprises at least one of alcohols, amine, or hydrocarbons.

5. The method, as recited in claim 1, wherein the ligand solvent comprises at least one of acetylacetonate (acac) family, acetic acid, amides, amidinates, allyls, ethylene, acetylene, and cyclo-pentadienyl.

6. A method of etching a stack with at least one metal layer in one or more cycles with each cycle comprising:

performing an initiation step, transforming part of the at least one metal layer into metal oxide, metal halide, or lattice damaged metallic sites; and

performing a reactive step comprising providing an organic solvent vapor to form a solvated metal, metal halide, or metal oxide state or providing an organic ligand solvent to form volatile organometallic compounds.

7. The method, as recited in claim 6, further comprising performing a desorption of the volatile organometallic compounds.

8. The method, as recited in claim 7, wherein the performing the desorption,

comprises heating the organometallic compounds.

9. The method, as recited in claim 6, wherein the organic solvent vapor comprises at least one of alcohols, amine, or hydrocarbons.

10. The method, as recited in claim 6, wherein the ligand solvent comprises at least one of acetylacetonate (acac) family, acetic acid, amides, amidinates, allyls, ethylene, acetylene, and cyclo-pentadienyl.

11. A method of etching a stack with at least one metal layer in one or more cycles with each cycle comprising:

performing an initiation step, transforming part of the at least one metal layer into metal oxide, metal halide, or lattice damaged metallic sites; and

performing a reactive step comprising providing an organic solvent vapor to form a solvated metal, metal halide, or metal oxide state.

12. The method, as recited in claim 11, further comprising performing a desorption of volatile organometallic compounds.

13. The method, as recited in claim 12, wherein the performing the desorption, comprises heating the organometallic compounds.

14. The method, as recited in claim 11, wherein the organic solvent vapor comprises at least one of alcohols, amine, or hydrocarbons.

15. The method, as recited in claim 11, further comprising forming a patterned mask, comprising:

etching a magnetic tunnel junction layer formed over the stack with an ion beam etch or reactive ion etch;

forming a spacer layer over the magnetic tunnel junction layer; and

opening the spacer layer.

16. A method of etching a stack with at least one metal layer in one or more cycles with each cycle comprising:

performing an initiation step, transforming part of the at least one metal layer into metal oxide, metal halide, or lattice damaged metallic sites; and

performing a reactive step providing an organic ligand solvent to form volatile organometallic compounds.

17. The method, as recited in claim 16, further comprising performing a desorption of the volatile organometallic compounds.

18. The method, as recited in claim 17, wherein the performing the desorption,

comprises heating the organometallic compounds.

19. The method, as recited in claim 16, wherein the ligand solvent comprises at least one of acetylacetonate (acac) family, acetic acid, amides, amidinates, allyls, ethylene, acetylene, and cyclo-pentadienyl.

20. The method, as recited in claim 16, further comprising forming a patterned mask, comprising:

etching a magnetic tunnel junction layer formed over the stack with an ion beam etch or reactive ion etch;

forming a spacer layer over the magnetic tunnel junction layer; and

opening the spacer layer.