CLAIMS

1. A method for processing a substrate, comprising:

providing a substrate including a metal layer, a dielectric layer arranged on the metal layer, and at least one of a via and a trench formed in the dielectric layer;

depositing metal using chemical vapor deposition (CVD) during a first deposition period, wherein the first deposition period is longer than a first nucleation delay period that is required to deposit the metal on the metal layer;

stopping the first deposition period prior to a second nucleation delay period, wherein the second nucleation delay period is required to deposit the metal on the dielectric layer;

performing a growth interruption treatment to interrupt growth of the metal on the dielectric layer, wherein the growth interruption treatment comprises one of:

an ammonia soak during a soak period; or

a fluorine soak during a soak period;

performing the depositing and the stopping N times, where N is an integer greater than or equal to one; and

after the performing, depositing the metal using CVD during a second deposition period that is longer than the second nucleation delay period.

2. The method of claim 1, wherein the metal comprises tungsten.

3. The method of claim 1, wherein the metal layer comprises tungsten.

4. The method of claim 1, further comprising depositing a nucleation layer prior to the first deposition period.

5. The method of claim 4, wherein the nucleation layer comprises one of fluorine-free tungsten layer and a tungsten/tungsten-nitride layer.

6. The method of claim 4, wherein the nucleation layer has a thickness between 2 Angstroms and 30 Angstroms.

~~7. The method of claim 1, further comprising performing a growth interruption treatment to interrupt growth of the metal on the dielectric layer after the stopping and before at least one of another one of the N times and the second deposition period.~~

~~8~~7. The method of claim ~~7~~1, wherein the growth interruption treatment comprises performing ~~an~~the ammonia soak during ~~a~~the soak period

~~9~~8. The method of claim ~~7~~1, wherein the growth interruption treatment comprises performing ~~a~~the flourine soak during ~~a~~the soak period.

~~10~~9. The method of claim 4, further comprising performing a sputter etch process prior to the first deposition period to remove the nucleation layer in the via at a contact bottom to expose the metal layer.

~~11~~10. A method for processing a substrate, comprising:

providing a substrate including a metal layer, a dielectric layer arranged on the metal layer, and at least one of a via and a trench formed in the dielectric layer;

during a first deposition period, depositing metal using physical vapor deposition (PVD);

depositing the metal using chemical vapor deposition (CVD) during a second deposition period, wherein the second deposition period is longer than a first nucleation delay period required to deposit the metal on the metal layer;

stopping the second deposition period prior to a second nucleation delay period, wherein the second nucleation delay period is required to deposit the metal on the dielectric layer;

performing a growth interruption treatment to interrupt growth of the metal on the dielectric layer, wherein the growth interruption treatment comprises one of:

an ammonia soak during a soak period; or

a fluorine soak during a soak period;

performing the CVD depositing and the stopping N times, where N is an integer greater than or equal to one; and

after the performing, depositing the metal using CVD during a third deposition period that is longer than the second nucleation delay period.

~~12~~11. The method of claim ~~11~~10, wherein the metal comprises tungsten.

~~13~~12. The method of claim ~~11~~10, wherein the metal layer comprises tungsten.

~~14. The method of claim 11, further comprising depositing a nucleation layer prior to the first period.~~

~~15. The method of claim 14, wherein the nucleation layer comprises one of fluorine-free tungsten layer and a tungsten/tungsten-nitride layer.~~

~~16. The method of claim 14, wherein the nucleation layer has a thickness between 2 Angstroms and 30 Angstroms.~~

~~17. The method of claim 11, further comprising performing a growth interruption treatment to interrupt growth of the metal on the dielectric layer after the stopping and before at least one of another one of the N times and the third deposition period.~~

~~18~~13. The method of claim ~~17~~10, wherein the growth interruption treatment comprises performing ~~an~~the ammonia soak for ~~a~~the soak period.

~~19~~14. The method of claim ~~17~~10, wherein the growth interruption treatment comprises performing ~~a~~the fluorine soak for ~~a~~the soak period.

~~20~~15. The method of claim ~~11~~10, wherein the PVD comprises directional PVD.

~~21~~16. The method of claim ~~11~~10, wherein the PVD comprises non-directional PVD.

~~22~~17. ~~The~~A method ~~of claim 21, further~~for processing a substrate, comprising:

providing a substrate including a metal layer, a dielectric layer arranged on the metal layer, and at least one of a via and a trench formed in the dielectric layer;

during a first deposition period, depositing metal using physical vapor deposition (PVD);

depositing the metal using chemical vapor deposition (CVD) during a second deposition period, wherein the second deposition period is longer than a first nucleation delay period required to deposit the metal on the metal layer;

stopping the second deposition period prior to a second nucleation delay period, wherein the second nucleation delay period is required to deposit the metal on the dielectric layer;

performing the CVD depositing and the stopping N times, where N is an integer greater than or equal to one;

after the performing, depositing the metal using CVD during a third deposition period that is longer than the second nucleation delay period; and

performing a sputter etch process to etch the metal from sidewalls of the via prior to the second deposition period and third deposition period.

~~23~~18. ~~The~~A method ~~of claim 21, further~~for processing a substrate, comprising:

providing a substrate including a metal layer, a dielectric layer arranged on the metal layer, and at least one of a via and a trench formed in the dielectric layer;

during a first deposition period, depositing metal using physical vapor deposition (PVD);

depositing the metal using chemical vapor deposition (CVD) during a second deposition period, wherein the second deposition period is longer than a first nucleation delay period required to deposit the metal on the metal layer;

stopping the second deposition period prior to a second nucleation delay period, wherein the second nucleation delay period is required to deposit the metal on the dielectric layer;

performing the CVD depositing and the stopping N times, where N is an integer greater than or equal to one;

after the performing, depositing the metal using CVD during a third deposition period that is longer than the second nucleation delay period; and

performing a sputter etch process to etch the metal from a field of the substrate, the trench and sidewalls of the via prior to the second deposition period and the third deposition period.