

CLAIMS

1. A processing method comprising:

placing a substrate having a substrate surface into a processing chamber comprising a plurality of sections, each section separated from adjacent sections by a gas curtain, the substrate surface having at least one feature with a top, bottom and sides and an aspect ratio of greater than or equal to 10:1;

exposing at least a portion of the substrate surface to a first process condition in a first section of the processing chamber, the first process condition comprising a precursor of titanium, aluminum, silicon, or combinations thereof;

laterally moving the substrate surface through a gas curtain to a second section of the processing chamber;

exposing the substrate surface to a second process condition in the second section of the processing chamber, the second process condition comprising a reactant to form a film with the precursor of titanium, aluminum, silicon or combinations thereof, the film comprising TiN, TiN, TiON, TiSiN, TiSiON, AlN, TiAlN, or TiAlON;

optionally repeating exposure to the first and second sections, including lateral movement of the substrate surface to form an underlying layer;

laterally moving the substrate surface through a gas curtain to a third section of the processing chamber;

exposing the substrate surface to a third process condition in the third section of the processing chamber, the third process condition comprising a tungsten precursor or molybdenum precursor;

laterally moving the substrate surface through a gas curtain to a fourth section of the processing chamber;

exposing the substrate surface to a fourth process condition in the fourth section of the processing chamber, the fourth process condition comprising hydrogen as a reductant to form a film with the tungsten or molybdenum precursor; and

optionally repeating exposure to the third and fourth sections, including lateral movement of the substrate surface to fill the feature.

2. The processing method of claim 1, wherein the reductant consists essentially of hydrogen.
3. The processing method of claim 1, wherein the first process condition comprises the precursor of titanium, which is TiCl_4 , TiI_4 , or $\text{Ti}[\text{NMe}_2]_4$ and the second process condition comprises NH_3 to form the underlying layer that comprises TiN .
4. The method of claim 1, wherein prior to exposing the substrate surface to the second process condition, the substrate is exposed to a chemical treatment process condition in a chemical treatment section of the processing chamber, the chemical treatment process condition comprising one or more of the following:
 - $\text{Si}_x\text{H}_{2x+2}$, wherein $x \geq 1$;
 - $\text{Si}_x\text{H}_y\text{F}_z$, wherein $x \geq 2$ and $y + z = 2x + 2$;
 - $\text{Si}_x\text{H}_y\text{Cl}_z$, wherein $x \geq 2$ and $y + z = 2x + 2$;
 - B_xH_y , wherein $x \geq 2$ and $y \leq 2x + 2$;
 - $\text{B}_x\text{H}_y\text{Cl}_z$, wherein $x \geq 2$ and $y + z \leq 2x + 2$;
 - $\text{B}_x\text{H}_y\text{F}_z$, wherein $x \geq 2$ and $y + z \leq 2x + 2$; and
 - $\text{B}_x\text{H}_y\text{R}_z$, wherein $x \geq 2$, $y + z \leq 2x + 2$, and R comprises an alkyl group having 1 to 6 carbons.