

ABSTRACT OF THE DISCLOSURE

ATOMIC LAYER ETCHING OF TUNGSTEN AND OTHER METALS

Provided herein are methods of atomic layer etching (ALE) of metals including tungsten (W) and cobalt (Co). The methods disclosed herein provide precise etch control down to the atomic level, with etching as low as 1 Å to 10 Å per cycle in some embodiments. In some embodiments, directional control is provided without damage to the surface of interest. The methods may include cycles of a modification operation to form a reactive layer, followed by a removal operation to etch only this modified layer. The modification is performed without spontaneously etching the surface of the metal.

FIG. 5