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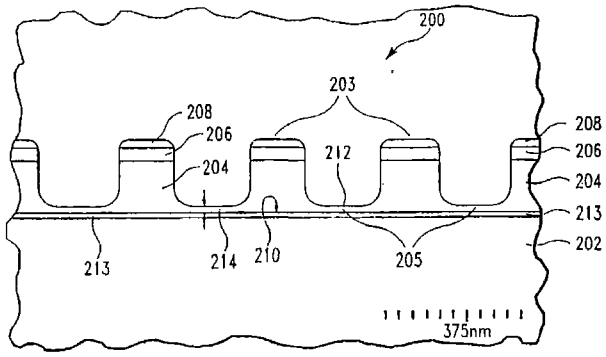
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(54) Title: METHOD OF ETCHING TUNGSTEN OR TUNGSTEN NITRIDE ELECTRODE GATES IN SEMICONDUCTOR STRUCTURES



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(57) Abstract: The present invention relates to a method of etching tungsten or tungsten nitride in semiconductor structures, and particularly to the etching of gate electrodes which require precise control over the etching process. We have discovered a method of etching tungsten or tungsten nitride which permits precise etch profile control while providing excellent selectivity, of at least 175:1 for example, in favor of etching tungsten or tungsten nitride rather than an adjacent oxide layer. Typically, the oxide is selected from silicon oxide, silicon oxynitride, tantalum pentoxide, zirconium oxide, and combinations thereof. The method appears to be applicable to tungsten or tungsten nitride, whether deposited by physical vapor deposition (PVD) or chemical vapor deposition (CVD). In particular, an initial etch chemistry, used during the majority of the tungsten or tungsten nitride etching process (the main etch), employs the use of a plasma source gas where the chemically functional etchant species are generated from a combination of sulfur hexafluoride (SF_6) and nitrogen (N_2), or in the alternative, from a combination of nitrogen trifluoride (NF_3), chlorine (Cl_2), and carbon tetrafluoride (CF_4). Toward the end of the main etching process, a second chemistry is used in which the chemically functional etchant species are generated from Cl_2 and O_2. This final portion of the etch process may be referred to as an "overetch" process, since etching is carried out to at least the surface underlying the tungsten or tungsten nitride. However, this second etch chemistry may optionally be divided into two steps, where the plasma source gas oxygen content and plasma source power are increased in the second step.

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