CONTROL OF SiO_2 ETCH RATE USING DILUTE CHEMICAL ETCHANTS IN THE PRESENCE OF A MEGASONIC FIELD

ABSTRACT

Processes for cleaning a silicon body and for controllably decreasing the thickness of a silicon dioxide layer overlying a silicon substrate are disclosed. The processes comprise chemically etching a silicon dioxide layer with a dilute etchant in the presence of a megasonic field. The concentration of the etchant is preferably less than its diffusion-rate-limiting threshold concentration at a given temperature. When aqueous alkaline hydroxyl ion etchants are employed, the concentration of etchant is preferably less than about 300 ppm by weight relative to water. The etching is discontinued before the silicon substrate is exposed to the etchant. The etch rate is controlled to within about 2×10^{-5} μm/min (0.2 Å/min) of a target etch rate which ranges from about 3×10^{-5} μm/min (0.3 Å/min) to about 4×10^{-4} μm/min (4.0 Å/min). A simpler, more cost-effective chemical process for robustly cleaning silicon bodies or for producing very thin gate oxides is achieved.

No figure