ANISOTROPY AND SELECTIVITY INTERDEPENDENCE USING NF_3 GAS MIXTURES

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Semiconductor manufacturing involves a complex series of sequential pattern transfer processes. The design rules needed to successfully manufacture advanced gigabit microdevices must include plasma processes with a high degree of etch anisotropy and high reaction selectivity of over-layered materials. Even with the continued tightening of anisotropy and selectivity requirements, little has been published regarding the interdependence of these important etch characteristics. The main objective of this research was to develop and define the parametric dependencies of silicon to silicon dioxide reaction selectivity and silicon etch anisotropy.

Plasma etching was investigated using NF_3 mixtures to generate a low-pressure plasma in a diode reactor. Nitrogen trifluoride was mixed with various combinations of CF_2Cl_2 and argon. Plasma pressure, power density and chemical composition were varied. Silicon and silicon dioxide reaction rates and silicon to silicon dioxide reaction selectivity were established. Etch anisotropy from a silicon patterning process was determined. The data were correlated using three-dimensional surface response methodology.