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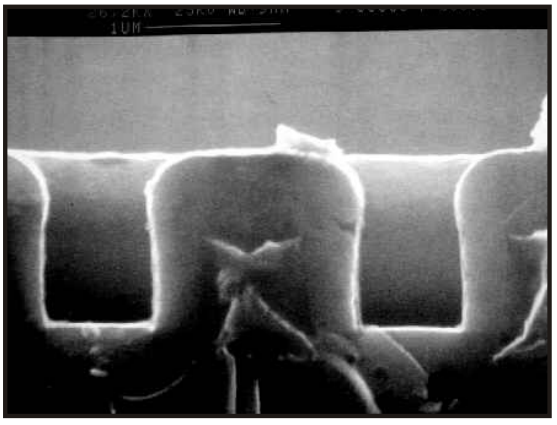
Plasmalab Data

Plasma-Deposition (PECVD) of SiO_2

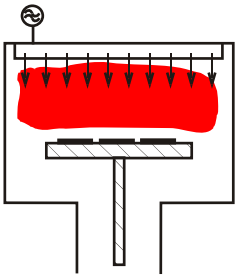
High Rate Excellent Uniformity - Low Stress - High Breakdown Strength

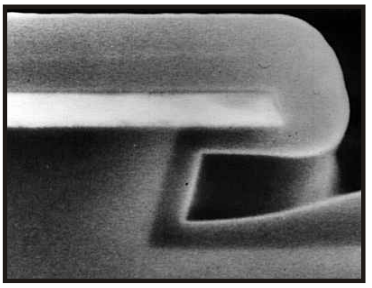
Applications of silicon dioxide films include passicvation layers, intermetal dielectric layers, scratch protection layers, optical waveguides, and lithographic / etch masks. Plasma Enhanced Chemical Vapour Deposited (PECVD) silicon dioxides are particularly suited to these applications due to their excellent electrical properties, adhesion, step coverage, and scratch resistance. The low deposition temperature of PECVD films (200-400° C) is of special importance for applications in which high temperatures are prohibited e.g. metallized wafers or GaAs. High rate deposition is possible with selection of the appropriate machine configuration. Silicon dioxide films normally have a low compressive stress, but the film stress can be adjusted for each particular application by selection of suitable process conditions. The films can withstand annealing processes at temperatures far in excess of the deposition temperature of the films.



250 nm SiO_2 deposited over 1 µm wide lines

0.3 µm SiO_2 deposited over a 0.5 µm step





2 µm SiO_2 deposited over a test structure

Process Chemistry: SiH_4, N_2O, N_2
Deposition Rate: 50 - 300 nm/min
Refractive Index: typically 1.45-1.49
Uniformity: < 3% deposition rate,
<<1% refractive index
Breakdown strength: > 8 MV/cm
Film stress controllable: 0 to -0.5 GPa
Pinhole / Particle Density: < 0.1 / cm^2

Additionally, doped oxides (e.g. PSG, BSG, or BPSG) can be obtained by including phosphine or diborane in the gas mixture. This is useful for 'reflow' applications in which excellent step coverage and/or planarisation of surface topography is required. Doped oxides also find applications in optical waveguides, since the doping level provides accurate control over film refractive index.

OXFORD Plasma Technology can also provide TEOS based PECVD silicon dioxide for applications which require ultimate step coverage.