

High Selectivity Nitride Spacer Etch with HBr/SF₆/N₂ Chemistry in High Density Plasma Source

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ABSTRACT

When the nitride spacer etching is performed, one of the major difficulties is the low selectivity of nitride to oxide (<10:1). Recently a highly selective silicon nitride spacer process for sub 0.25 μm devices has been developed in a high density plasma etching system using an HBr/SF₆/N₂ chemistry. The selectivity of silicon nitride to thermal oxide greater than 20:1 was achieved at high pressure, high N₂, and low cathode temperature. A more systematic study about the process parameters such as N₂ flow rate, pressure and temperature, which affect the selectivity of nitride to oxide was done. Also it was found that the addition of 15% O₂ increased nitride etch rate, thus enhancing selectivity of nitride to oxide. The optimized recipe with high selective SF₆/HBr/N₂ chemistry achieved a smoother shoulder rounding with 150 Å loss of nitride width (initial sidewall nitride width: 950 Å), and bottom oxide loss of 8 Å.