Nitridation of SiO_2 surface by VHF (162 MHz)multi-tile push-pull plasma source

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As the gate dielectricthickness is scaled down and gate line-width is reduced, dense nitride layer (withhigh nitrogen content) as a gate dielectric layer has become important toprevent the penetration of p-type dopant through thin gate oxide. In general, asnitridation of SiO_2 layer, plasma nitridation and thermalnitridation method are used to obtain a nitride layer. But, in case of thermalmethod, high processing temperature above 250 ^oC causes degradationof device performance. In plasma nitridation, to obtain high nitrogen contentin the SiO_2 film, enhanced degree of N_2 dissociation isimportance issue. Due to high electron-impact dissociation energy of nitrogenmolecules, conventional 13.56~60 MHz CCP source is difficult to dissociate N_2 molecule sufficiently. So, a nitrogen percentage of the nitrided layer usingthat source are limited. In this study, a VHF (162 MHz) multi-tile plasmasource was used for the dissociation of N_2 molecule and the effect ofVHF multi-tile plasma source on the nitridation of silicon dioxide at roomtemperature was investigated. Using the VHF (162 MHz) multi-tile push-pullplasma source, nitrogen plasmas with high ion density above 1.0 x $10^{11}/cm^3$were generated and, with these plasmas, silicon oxynitride films with highnitrogen contents could be fabricated. In addition, MOS capacitor with siliconoxynitride using VHF source exhibited a low leakage current.